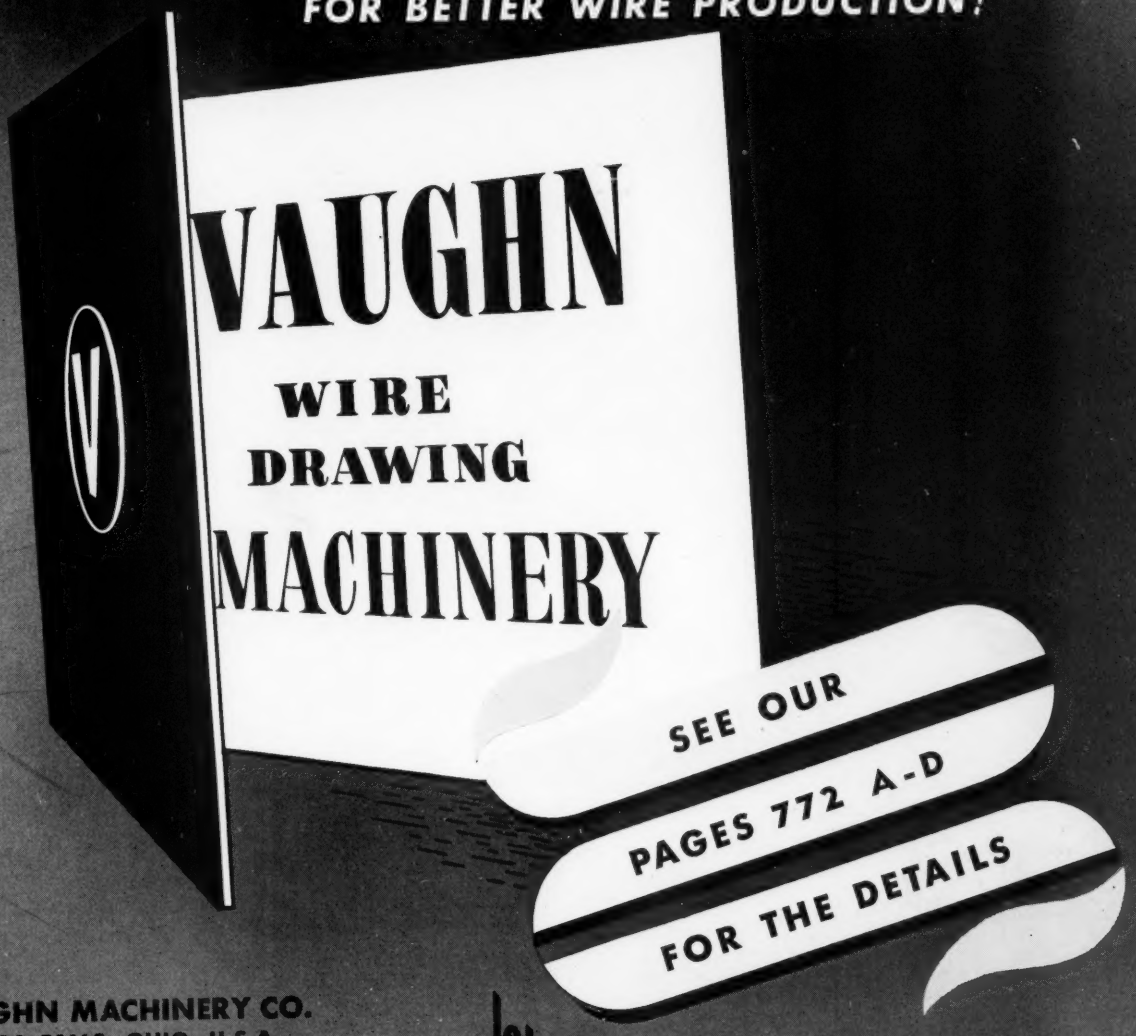
OCTOBER 1946

WIRE AND WIRE PRODUCTS

Your Four-Word DIRECTORY

FOR BETTER WIRE PRODUCTION!



THE VAUGHN MACHINERY CO.
CUYAHOGA FALLS, OHIO, U.S.A.

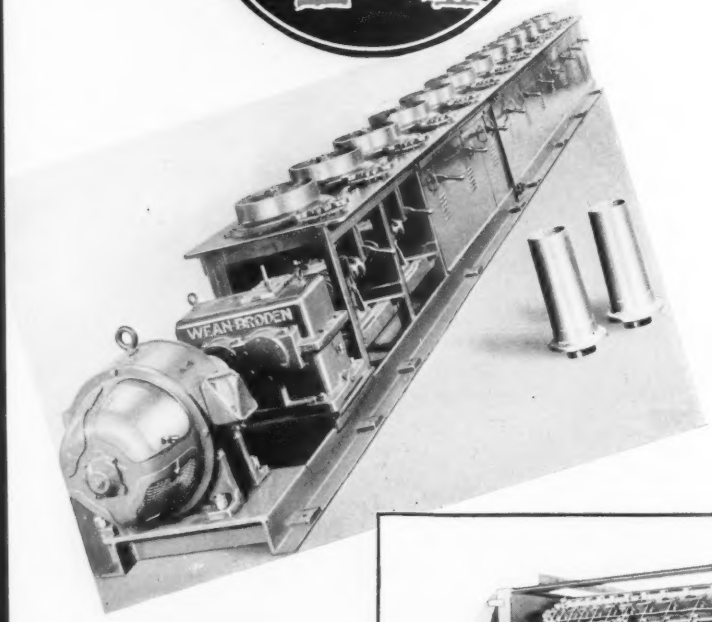
COMPLETE COLD DRAWING EQUIPMENT . . . Continuous or Single Hole . . . for the Largest Bars and Tubes . . . for the Smallest Wire . . . Ferrous, Non-Ferrous Materials or their Alloys.

Let us consult on your needs

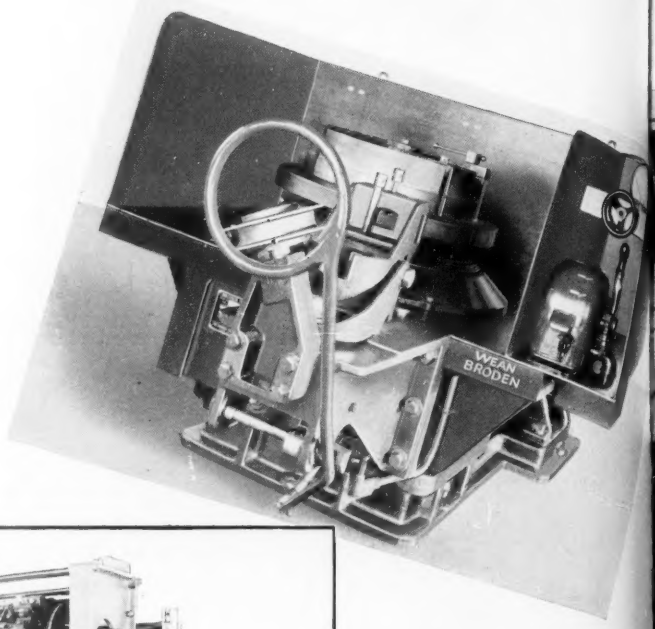
OFFICIAL PUBLICATION OF THE WIRE ASSOCIATION

WEAN • BRODEN

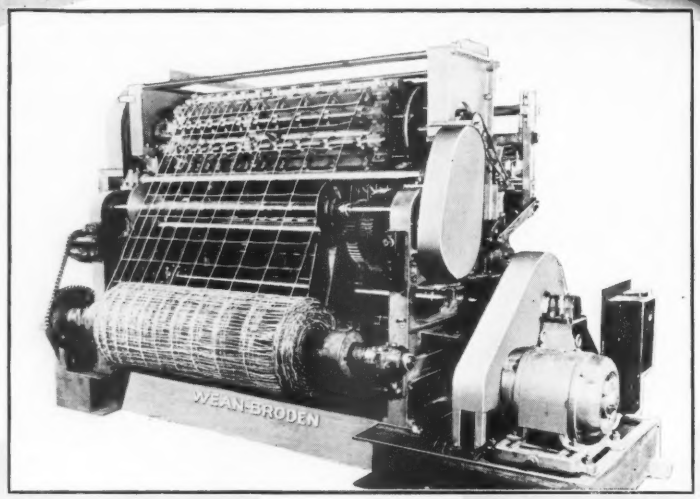
Wire Mill Machinery and Cold Rolling Equipment



12 block coarse wire tinning take-up frame

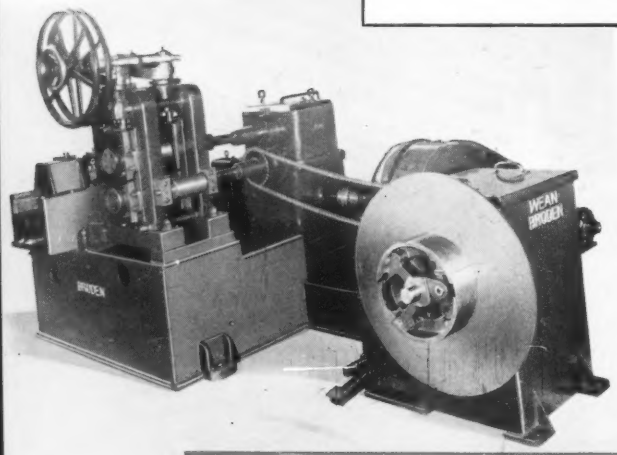


No. 5 rod double deck—2 draft wire drawing machine

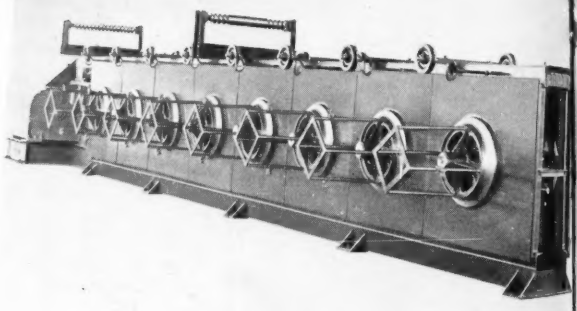


Combination edging and flattening mill with take-up reel

16 block wire galvanizing frame



No. 1155 farm and field fence machine



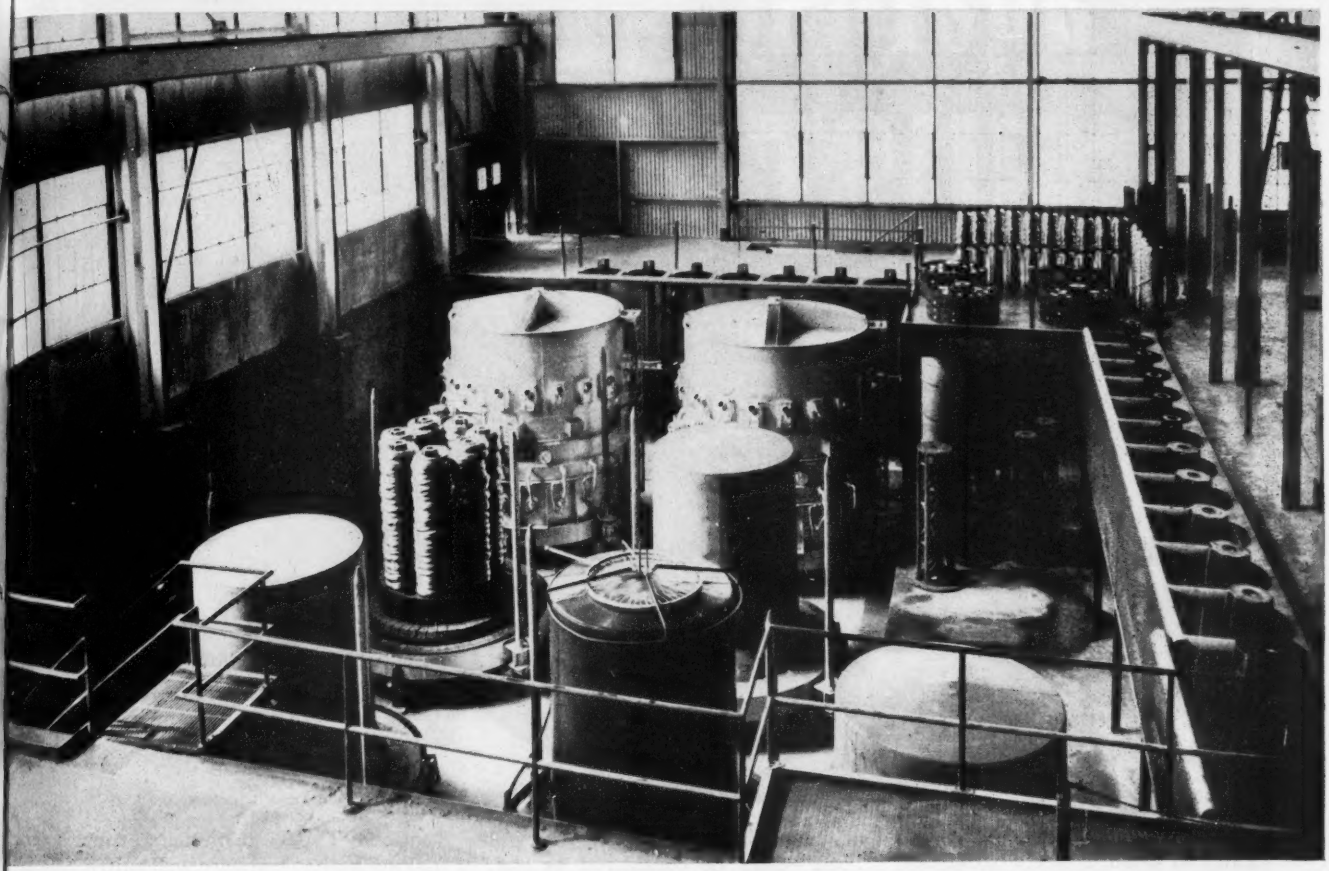
The BRODEN CONSTRUCTION Co., Inc., Cleveland, O.

A SUBSIDIARY COMPANY OF

The WEAN ENGINEERING Co., Inc., Warren, O.

The new *Wire Annealing* installation

at the Palmer Plant of the Wickwire Spencer Steel Division of the Colorado Fuel and Iron Corporation



TWO FURNACES—SIX BASES CHARGE SIZE—74" DIAMETER 84" HIGH

WILSON MULTIPLE STEM WIRE ANNEALING FURNACES FOR HEAVY PRODUCTION

ENGINEERED AND CONSTRUCTED BY

Lee Wilson ENGINEERING CO., Inc.

20005 West Lake Road CLEVELAND, OHIO

Telephone ACademy 4670

The Wilson Annealing Unit is covered by Patents Nos. 1,952,402, 2,068,477, 2,078,356, 2,081,612, 2,089,843 and other patents pending.

INDUSTRIAL FURNACES ★ RADIANT TUBE HEATING ★ HEAT TREATING PROCESSES

Rust has little chance to gain a foothold when it meets bethanized wire.

The bethanized coating is so resistant to rust because it is 99.9 per cent pure zinc, pure all the way through to the steel base. And because it's locked to the wire by an advanced electrolytic process, the coating is perfectly uniform, not only around but along the wire.

The bethanized coating is ductile, and adheres so tightly to the wire that for all practical purposes the two metals—the zinc and the steel base—may be considered as one. As evidence of the tightness and ductility of the coating, bethanized wire can be bent or twisted, wrapped around its own diameter, even drawn down to fine gauge, without flaking or peeling.

Bethanized coatings can be supplied in weights up to three times as heavy as those specified in conventional Type 3 galvanizing, thus making bethanized wire well suited for applications involving severe service conditions.

If you have a job for zinc-coated wire involving difficult forming operations or severe exposure to corrosive conditions, we suggest you consider the advantages bethanized wire has to offer. Complete information supplied on request.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

BETHLEHEM STEEL

★ Bethanized Wire ★

WIRE & WIRE PRODUCTS, Vol. 21, No. 10, October, 1946. Publication Office, 61 Cliff St., New York 7, N. Y. Executive Office, 300 Main St., Stamford, Conn. Published monthly by the Quinn-Brown Publishing Corp., Richard E. Brown, President; R. S. Spengel, Sec. and Treas. Subscription price: U. S., $5.00; Canada, $5.00 per year, 50 cents per copy; Foreign, $7.05 per year. Entered as second class matter, June 14, 1946, at the Post Office, New York, N. Y., under Act of March 3, 1879.

AJAX

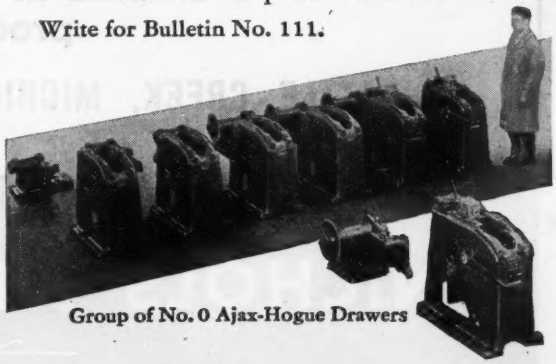
Hogue Wire Drawer

An Attachment which Improves the Quality and Lowers the Cost of Cold Heading

This attachment for any make of Cold Header lowers production costs and improves the quality and accuracy of the finished products. By providing freshly drawn and coated, clean, straight, accurate wire for the header dies, a high degree of uniformity is attained. The lower yield point of the freshly drawn wire allows the metal to flow more freely, filling out the die impressions. This makes heading easier, with considerably less wear on the dies.

The Ajax-Hogue Drawers are built in five sizes for wire diameters of ¼ to ¾ inch. Hot rolled stock is used instead of cold drawn wire, with the saving of the differential in the price of the two materials.

Write for Bulletin No. 111.



Group of No. 0 Ajax-Hogue Drawers

THE AJAX MANUFACTURING COMPANY

EUCLID BRANCH P. O. CLEVELAND 17, OHIO

110 S. DEARBORN ST. • CHICAGO 3, ILLINOIS

DEWART BUILDING • NEW LONDON, CONN.

ROUND OR FLAT

WIRE

BY NICHOLS

ALUMINUM — COPPER — STEEL (LOW CARBON)

Coarse — Intermediate — Fine Gauges

IN COILS — STRAIGHTENED AND CUT

produced at

BATTLE CREEK, MICHIGAN • DAVENPORT, IOWA

NICHOLS WIRE AND STEEL CO.

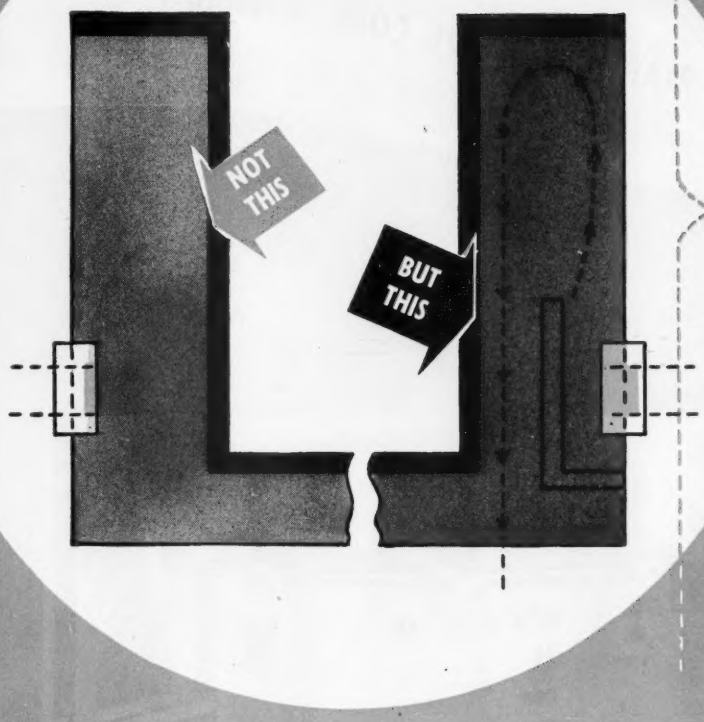
DAVENPORT, IOWA

Now!....LONG POT LIFE

WITH

F.E.I.

galvanizing furnaces



The F.E.I. Direct Fired Combustion System Eliminates Flame Impingement

★Installations in many plants have proved that F.E.I. equipped furnaces have shown several times the expected pot life when compared to combustion equipment of conventional design.

The F.E.I. combustion system provides uniform top to bottom temperatures by circulating hot gases around the pot, thus eliminating any localized overheating and subsequent burning of the pot. An interesting feature of F.E.I. direct firing is the low temperature differential between the combustion chamber and the pot. The F.E.I. combustion system is completely automatic. It provides sufficient fuel capacity for high production requirements as well as low turn down for minimum operating requirements and for holding during idling. The human element in control is eliminated entirely. F.E.I. Galvanizing Furnaces have proved lower fuel costs per ton, improved quality and uniform coating, and lower maintenance costs per tonnage coated.

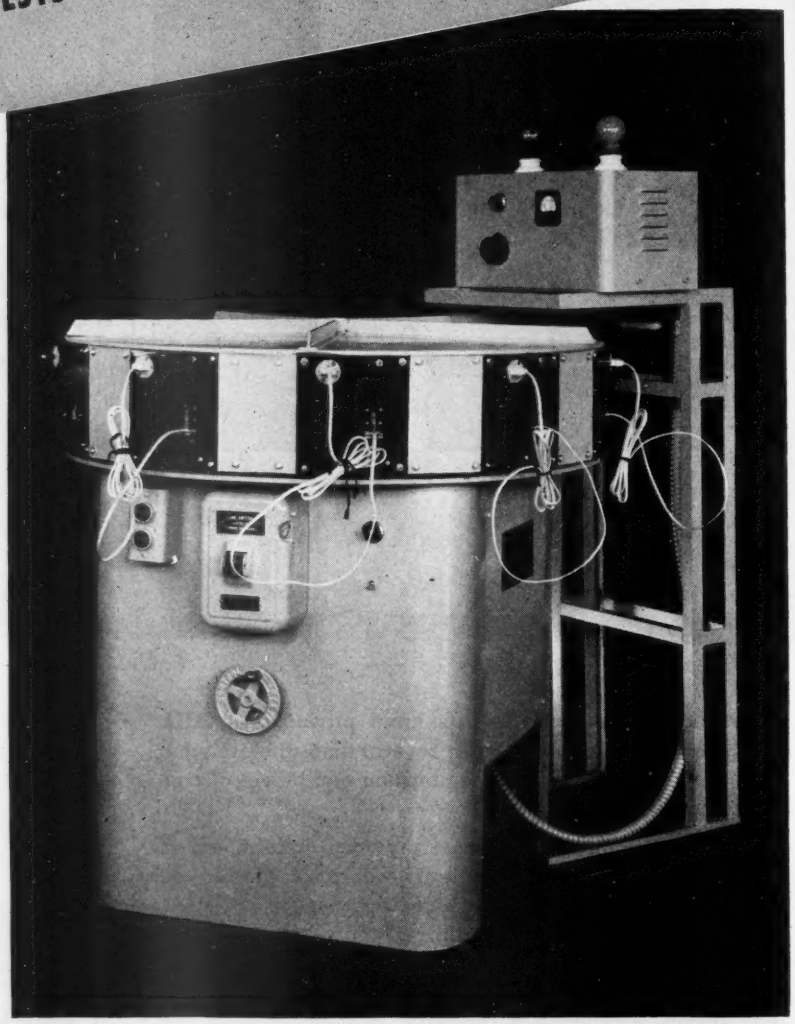
F.E.I.

FURNACE ENGINEERS, Inc.
1551 W. LIBERTY AVE., PITTSBURGH, PA.

FOREIGN REPRESENTATIVES
FOR CANADA: Salem Engineering (Canada) Ltd. Toronto, Ont.
FOR EUROPE, ASIA, AFRICA: Salem Engineering Co. Ltd. Milford, Nr. Derbey, England.

THE JLE AUTOMATIC CORD AND PLUG TESTER

AUTOMATICALLY TESTS MANY TYPES OF CORD ASSEMBLIES



FEATURES OF THE MACHINE INCLUDE:

1 High potential test between conductors.

2 High-Current test of continuity of copper.

3 Automatically rejects cords that fail.

4 Those cords that fail on high-potential and those that fail on continuity test are rejected separately.

5 Cord sets which pass both tests are automatically ejected at a third point.

6 Cord receptacle panels are easily removable and interchangeable to allow testing of various types of cord assemblies.

7 Machine capacity ranges from 1,200 to 3,600 cord sets per hour, depending on the type of cord assembly.

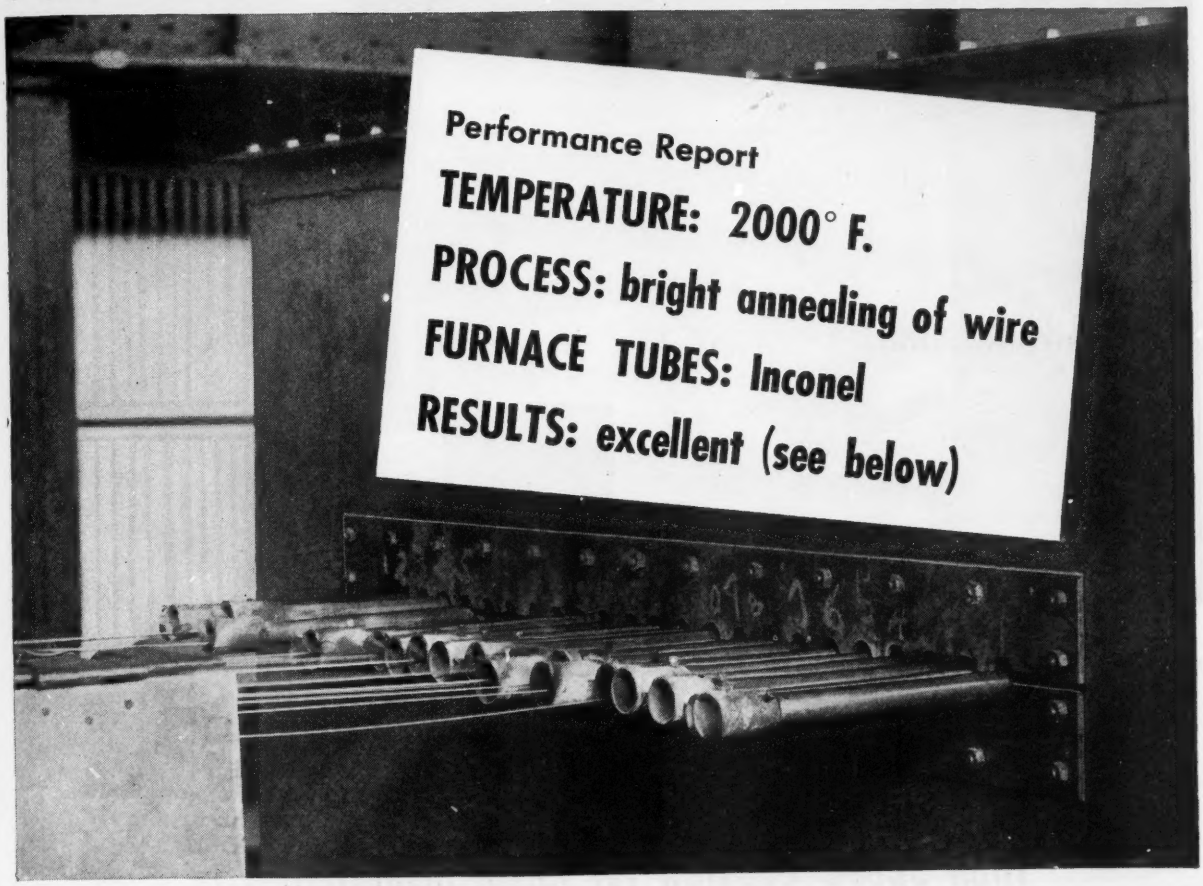
8 Speed of the rotating top assembly is variable in a 3 to 1 ratio.

Complete technical information and specifications are available. Ask for them.

JAMES L. ENTWISTLE CO.

43 CHURCH ST., PAWTUCKET, R. I.

WORLD'S LEADING MANUFACTURER OF SPARK-TESTING EQUIPMENT



In bright annealing furnaces of the Pittsburgh Steel Co., stainless steel wire moves continuously through tubes at 2000° F.

Within the tubes, a hydrogen and nitrogen atmosphere is maintained to prevent oxidation of the hot wire surface.

Inconel cold-drawn seamless tubing is used in Pittsburgh Steel Co. furnaces... as it is in general use in other bright annealing furnaces... because of the service it gives in this high-temperature application.

In the bright annealing of Nickel and Monel wire at 1900°—1950° F.... two years' life is reported for Inconel tubing, through the use of wire drawing lubricants free of lead and sulphur.

* * *

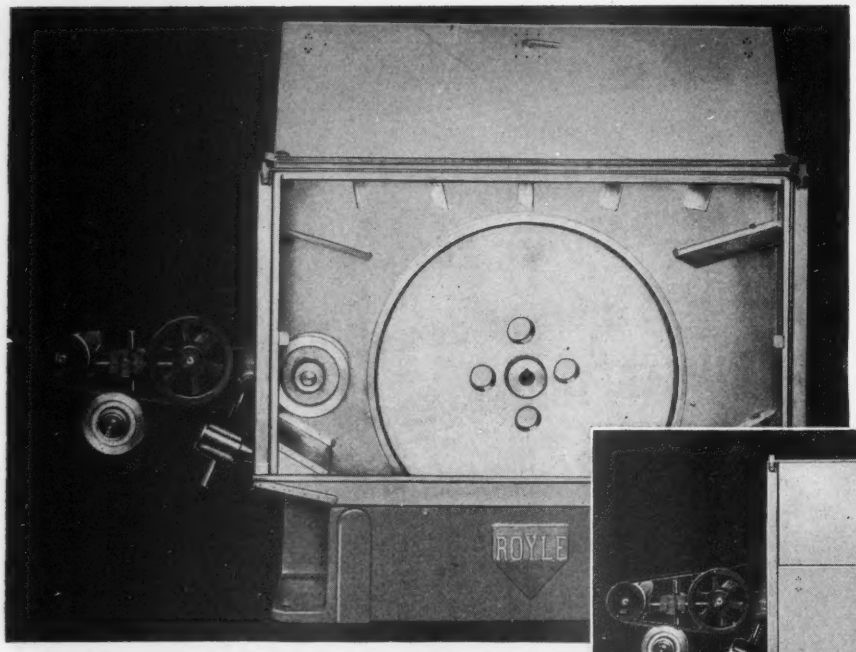
*The details of this use of Inconel, a wrought nickel-chromium, heat-resistant alloy, are published in the belief that they will be of interest and value to engineers and designers working on similar problems. Detailed information on Inconel can be found in: *"For Long Life at High Temperatures."* Send for your copy.

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street, New York 5, N.Y.

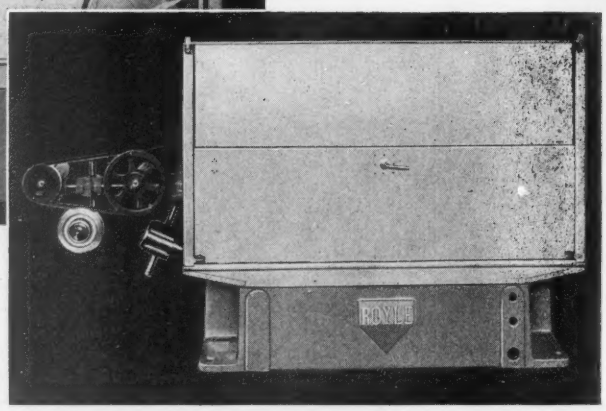
★ ★ ★ ★ ★ **NICKEL** INCO TRADE MARK **ALLOYS** ★ ★ ★ ★ ★

MONEL* • "K" MONEL* • "S" MONEL* • "R" MONEL* • "KR" MONEL* • INCONEL* • "Z" NICKEL* • NICKEL

*Reg. U. S. Pat. Off.



Fight Inflation Buy More Bonds!



THE ROYLE 36"

High Speed Capstan for Resin Insulated Wire

CHECK THESE FEATURES

★ Stainless steel watertight enclosure

★ Total enclosure permits higher wire speeds

★ More efficient wire puller stabilizes wire speed

★ Secondary idler pulleys guide wire across capstan preventing rubbing and permitting greater quantities of wire to be cooled simultaneously

★ Quiet running

★ All bearings are located outside of enclosure to prevent contact with water

★ Built-in air wiper

★ Full size folding side assures maximum accessibility

★ All interior surfaces which are touched by wire or spray are of aluminum or corrosion resisting metal to withstand the chemical reaction of the various resins

Write for Complete Details

JOHN ROYLE & SONS

ROYLE PATERSON N. J. 1880

PIONEERED THE CONTINUOUS EXTRUSION PROCESS IN

James Day (Machinery) Ltd. London, England REgent 2430

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PATERSON 3, NEW JERSEY

INSULATED WITH Du Pont POLYTHENE

With the home television set, much of the attenuation and distortion of images that sometimes occurs on the screen may arise in the lead-in cable from the antenna to the instrument. But not with the new Type ATV cable shown here. With this cable, attenuation is minimized . . . images are strong and clear.

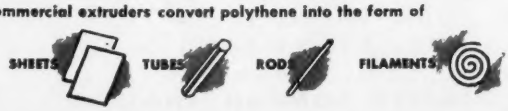
The unusual design of this new lead-in line deserves much credit for its high effectiveness. But note—what makes this design possible is the excellent electrical properties of the insulation, of Du Pont polythene.

Because of polythene's remarkable dielectric strength, a thin coating of it is all that is needed. Polythene's low power factor makes it unusually effective in every type of high-frequency circuit. Credit also polythene's light weight (specific gravity 0.92) and its ability to retain its toughness and flexibility over a wide range of temperatures.

For complete data sheet on polythene, write to E. I. du Pont de Nemours & Co. (Inc.), Plastics Dept. 1410, Arlington, N. J.

Du Pont manufactures polythene molding powder.

Commercial extruders convert polythene into the form of



Type ATV two-wire polythene-insulated cable, for use as television lead-in line between antenna and receiver, made by Anaconda Wire & Cable Co. (Photo 2.5 times actual size.) This rugged, flexible cable, one of the lightest of its type, has an attenuation of 0.75 db/100 feet, and an impedance of 300 ohms at 50 megacycles.

DU PONT
REG. U. S. PAT. OFF.
Plastics
BETTER THINGS FOR BETTER LIVING
. . . THROUGH CHEMISTRY

This modern ROSS OVEN

To give you Quality -- ALLOY RODS does this...
To Make Your Welding Job EASIER - BETTER - AT LESS COST With ARCALOY Extruded Stainless Electrodes
ARCALOY LIME COATINGS
ARCALOY AC-DC COATINGS
Write for this folder
You Can Do It Better With Arcaloy
ALLOY RODS CO. York, Pa.

Speeds production of ARCALOY Stainless Rods at new Alloy Rods plant

Meeting today's demand for extra *speed* in wire and rod baking requires an oven of unusual efficiency . . . one which gives you completely accurate control of every step in the baking process.

At the Alloy Rods Company's new plant in York, Pa., production of ARCALOY extruded stainless rods has been stepped up from 600 to 950 rods per minute by the use of the 90 foot ROSS BAKING OVEN shown above. This modern oven maintains reliably uniform control of air circulation and temperature . . . even at the higher speed necessary . . . to meet the exacting standards of ARCALOY rods. Both the Lime Coating and the AC-DC coating rods, which are designed to meet all possible stainless welding requirements, are accurately baked in this improved oven.

To speed your production without sacrificing quality, it will pay you to investigate the modern ROSS OVEN. Write us today for full information.

CHECK THESE MAJOR ROSS OVEN FEATURES:

- ★ Provides baking temperatures of from 125° to 450° F. depending upon type of electrode being processed.
- ★ Provides special means of varying conditions in various zones without changing rods from one oven to another.
- ★ Ingenious patented devices transfer rods from one conveyor to the other without marking or gouging.
- ★ Oven illustrated is the ROSS "UNIVERSAL", 90 feet long with 5-pass chain conveyor.

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J.O.ROSS ENGINEERING CORP.

DESIGNERS AND BUILDERS OF AIR PROCESSING SYSTEMS

ROSS CONTROL OF AIR FOR MODERN INDUSTRY SYSTEMS

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ROSS ENGINEERING OF CANADA, LIMITED — MONTREAL 19, P. Q.

CARRIER—ROSS ENGINEERING COMPANY, LIMITED, LONDON, ENGLAND

BECAUSE EVERY INCH IS LIKE EVERY OTHER INCH

ROEBLING Wire Helps Keep Production Rolling...

and Cuts Costs!

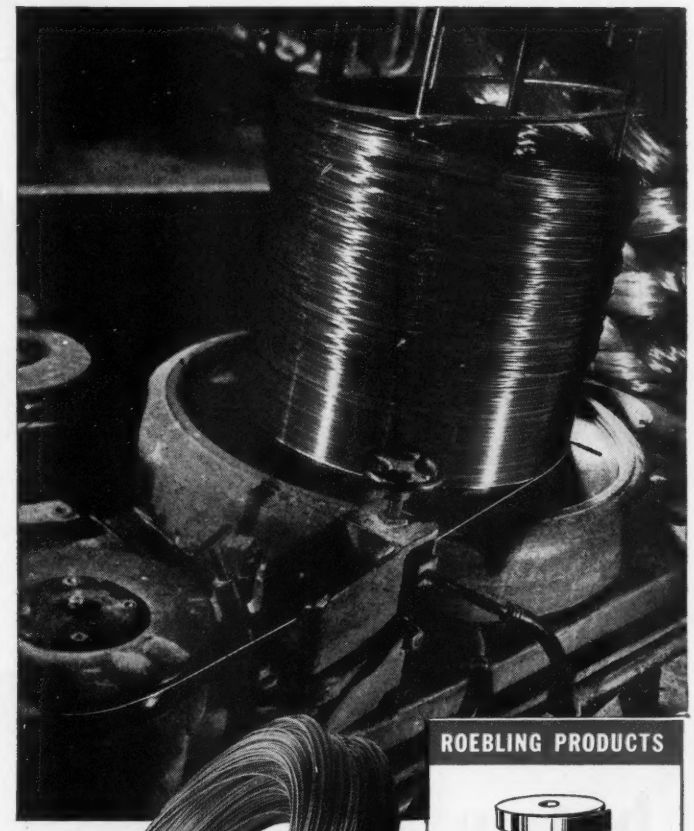
When you specify Roebling Round Wire you expect to get wire that meets *all* your specifications exactly. And because you do get it that way—absolutely uniform in quality every inch of the way—you can figure on saving three ways:

1. **Rejects and scrap dwindle to a minimum.**
2. **Shutdowns are fewer, production schedules better maintained.**
3. **Output is up, for preparation time is less . . . operation faster, smoother.**

Improve your product with the right wire—right throughout in grain structure and gauge and temper, ductility and finish—by checking with Roebling. Roebling has the equipment and the experience to take your most exacting wire requirements in stride. And with his wide industrial background, your Roebling Field Engineer may well be able to show you new ways of cutting production corners—and costs—with Roebling Round Wire.

JOHN A. ROEBLING'S SONS COMPANY
TRENTON 2, NEW JERSEY
Branches and Warehouses in Principal Cities

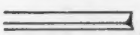
Manufacturers of Wire Rope and Strand • Fittings • Slings • Aircord, Aircord Terminals and Air Controls • Suspension Bridges and Cables • Aerial Wire Rope Systems • Ski Lifts • Hard, Annealed or Tempered High and Low Carbon Fine and Specialty Wire, Flat Wire, Cold Rolled Strip and Cold Rolled Spring Steel • Screen, Hardware and Industrial Wire Cloth • Electrical Wire and Cable • Lawn Mowers



Round Wire

ROEBLING PRODUCTS

Flat Wire

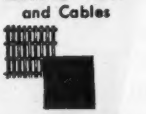


Shaped Wire

Strip Steel

Wire Rope

Electrical Wires and Cables



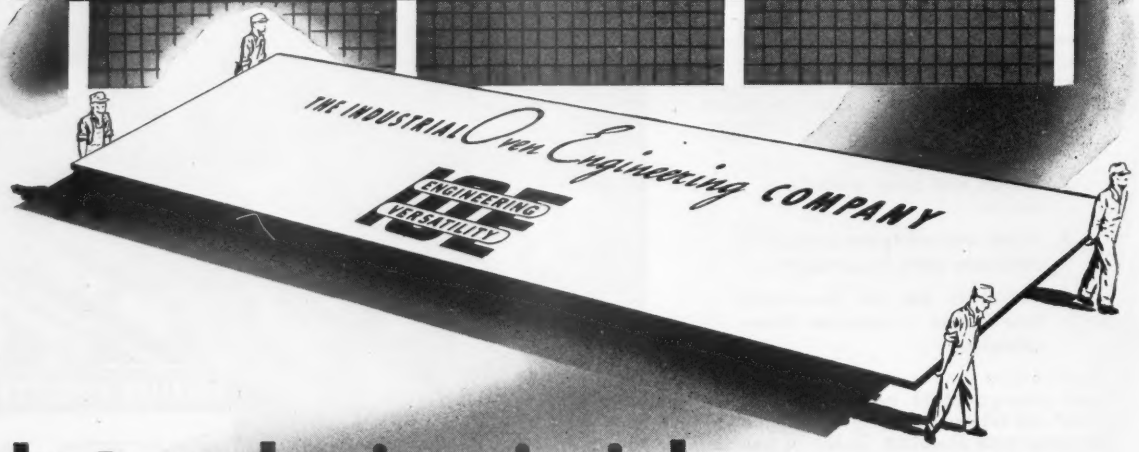
Woven Wire Fabrics

ROEBLING

PACEMAKER IN WIRE PRODUCTS

We've changed our name to

INDUSTRIAL IOI OVENS, INC.



but our basic principle is the SAME –

We've changed our name to Industrial Ovens, Inc. to define more clearly the scope of our service to industry. That service consists of the engineering, design and installation of systems and equipment for oven treating and processing operations.

As the Industrial Oven Engineering Company this organization has been responsible for increasing and speeding up production and lowering production costs in a wide range of industries—wire, rubber, textile, plastic, ceramic, metal finishing and many others.

If you have a production problem involving oven treating or processing, *the engineered application of heat in continuous material-handling operations* can help you—and that means Industrial Ovens, Inc. can help you. Write today for literature describing IOI installations in your field.

INDUSTRIAL IOI OVENS, INC.

13825 TRISKETT ROAD CLEVELAND 11, OHIO

ASSOCIATED COMPANY: JAMES DAY MACHINERY LTD., LONDON W 1, ENGLAND

Are YOU taking full advantage of FIBERGLAS?

for
Building wire—Magnet wire—High-temperature constructions—Manufacturers and Circuit identification tracers—Appliance cord—Ballast wiring—Neon sign cord—Conductor insulation and inorganic filler in large cables—tension members in cable construction.

Fiberglas Yarns are available in a wide variety of packages to meet the requirements of wire manufacturers. Fiberglas in several forms is used in the manufacture of other Electrical Insulation Materials. The complete line of Fiberglas Electrical Insulation Materials is described in booklet EL-46-11; if you do not have a copy, write for one today.

Fiberglas technicians will be glad to co-operate with you in the selection of the Fiberglas material best suited to your needs and for the development of your new products. Write for complete information: Owens-Corning Fiberglas Corporation, Dept. 875, Toledo 1, Ohio. Branches in principal cities.

In Canada, Fiberglas Canada Ltd., Toronto, Ontario

OWENS-CORNING
FIBERGLAS
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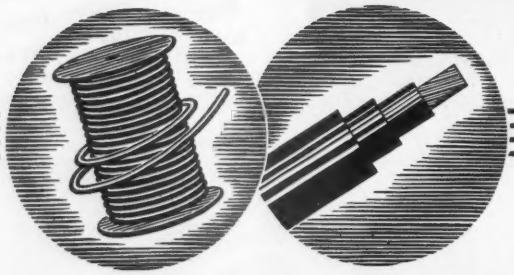
SPECIALIZED RESEARCH EXPERIENCE



In All Types of Insulating Finishes and Impregnating Materials.

All Formulations made to individual specifications and to meet unusual requirements.

Our Hot-melt, Flame-resistant Compounds are non-toxic.

STANDARD VARNISH WORKS

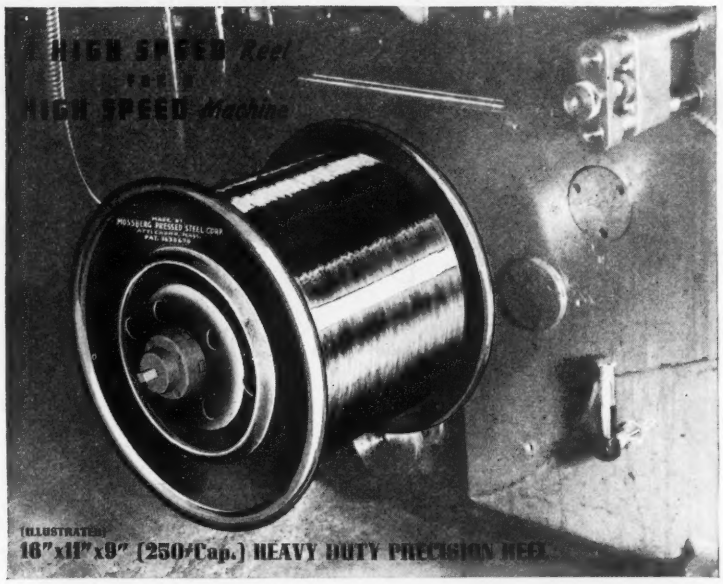
Engineers of Product Finishes

NEW YORK - CHICAGO

SERVING INDUSTRY FOR 75 YEARS

WELCOME

GREETINGS



MOSSBERG PRESSED STEEL CORP.

OFFERS: BALANCED PRECISION REELS

in HEAVY DUTY construction for use on modern HIGH SPEED wire drawing machines.

To provide higher operating efficiency, with the ever increasing tendency towards the drawing of finer gauge wire on larger reels at higher speeds, the following reel requirements are now essential:

(1) PROPER PROPORTION
(2) BALANCE
(3) ACCURACY
(4) STRENGTH
(5) DURABILITY

All these requirements are incorporated in spools & reels made by

MOSSBERG PRESSED STEEL CORP.

18 WEST STREET ATTLEBORO, MASS. U. S. A.

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to the

Annual Convention of the Wire Association

1946

Soaps and Compounds for..

Brass & Bronze

HIGH CARBON

Coat Hanger Wire

DRY AND WET DRAWING OF FERROUS AND NON-FERROUS WIRE, TUBING, AND DEEP DRAWN PARTS

LOW CARBON

Copper

Our Engineers Will Be Glad to Cooperate With You in Finding the Most Economical and Efficient Solution to Your Drawing Problem.

STAINLESS STEEL

Spring Wire

STEELSKIN

TOOL STEELS

Write or Telephone

R. H. MILLER CO., Inc.

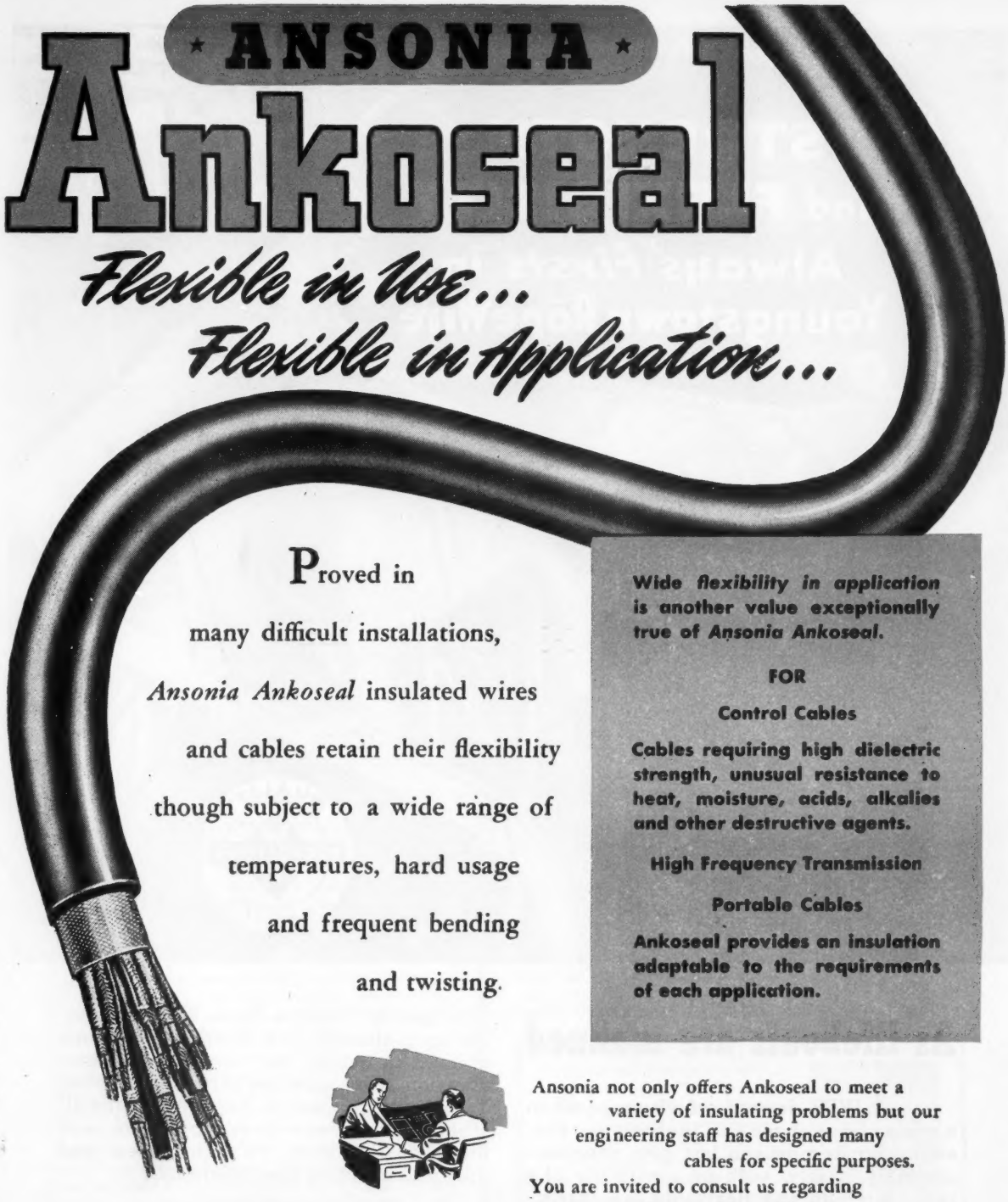
HOMER,
New York

Established
1909

★ ANSONIA ★ Ankoseal

Flexible in Use...

Flexible in Application...



Proved in many difficult installations, *Ansonia Ankoseal* insulated wires and cables retain their flexibility though subject to a wide range of temperatures, hard usage and frequent bending and twisting.

Wide *flexibility in application* is another value exceptionally true of *Ansonia Ankoseal*.

FOR

Control Cables

Cables requiring high dielectric strength, unusual resistance to heat, moisture, acids, alkalies and other destructive agents.

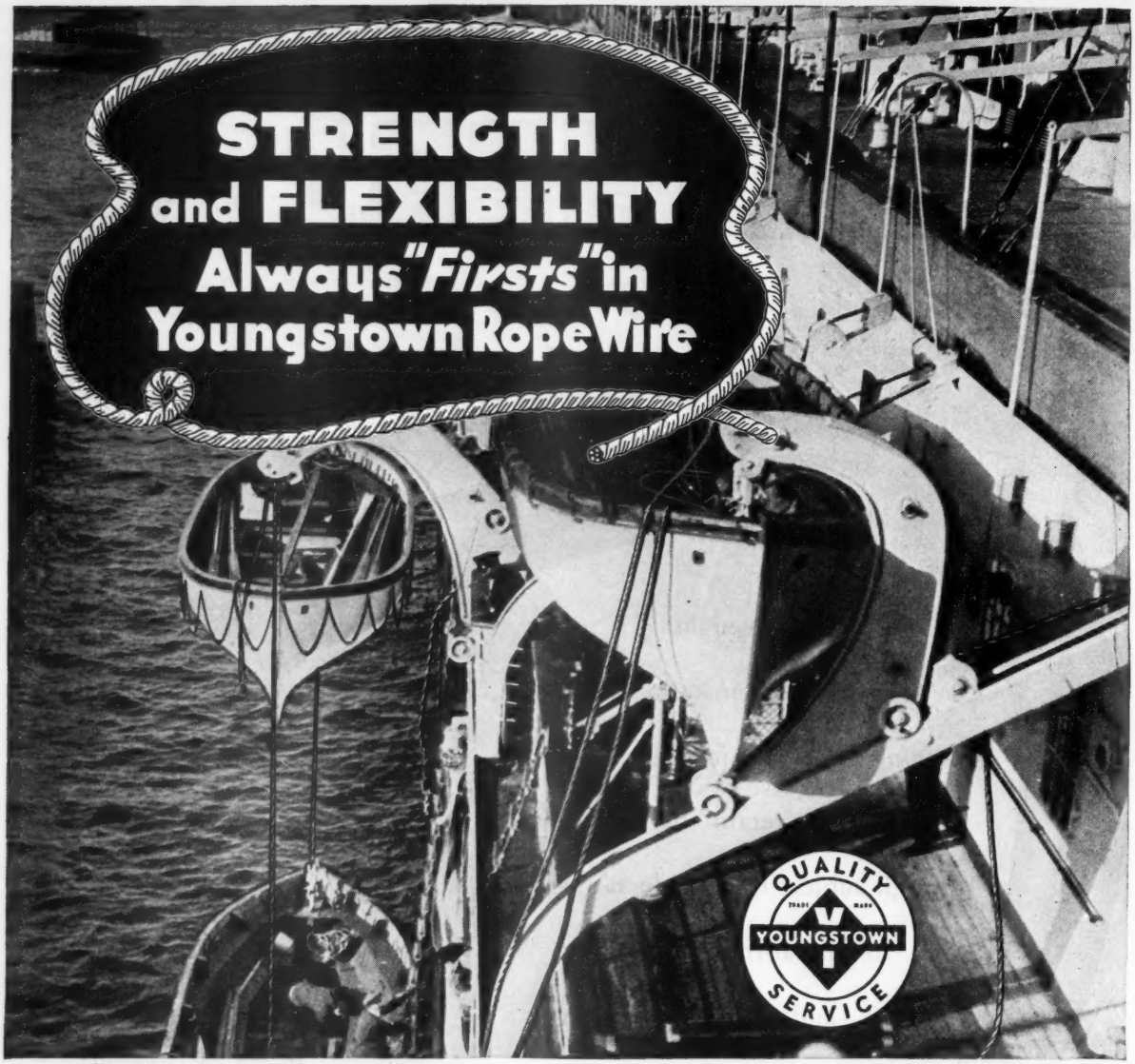
High Frequency Transmission

Portable Cables

Ankoseal provides an insulation adaptable to the requirements of each application.

Ansonia not only offers Ankoseal to meet a variety of insulating problems but our engineering staff has designed many cables for specific purposes. You are invited to consult us regarding your wire or cable problems.

THE ANSONIA ELECTRICAL DIVISION
ANSONIA, CONNECTICUT *of*
NOMA ELECTRIC CORPORATION, NEW YORK, N. Y.



As lifeboats are manned

LIVES depend on wire rope when a crisis comes at sea and lifeboats are lowered. Ropes must run fast over sheaves--smoothly, surely, with no possibility of a jam. Strength and flexibility are "firsts."

Wire rope can be no better than the wire from which it is woven. Quality in the wire must start in the steel. Rope woven from Yolectro High Carbon Rope Wire can be dependably strong and flexible, because strength and flexibility are built into it--guarded at every step of production, from the charging of the open hearth to the final inspections.

So specify Yolectro Rope Wire to measure up in strength and flexibility. It runs uniform in gauge, has toughness to resist abrasion, has properties to resist corrosion. Yolectro High Carbon Rope Wire, like all other Youngstown wire mill products, is of finest quality steel, refined, rolled and drawn to exacting specifications.

Photo—Courtesy Preformed Wire Rope Information Bureau.

YOUNGSTOWN

THE YOUNGSTOWN SHEET AND TUBE COMPANY

GENERAL OFFICES - YOUNGSTOWN 1, OHIO

Export Offices - 500 Fifth Avenue, New York City

Manufacturers of

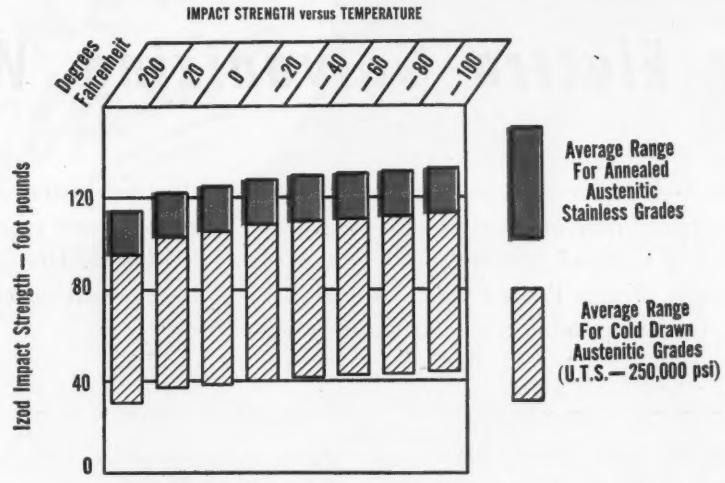
CARBON - ALLOY AND YOLOY STEELS

Bars-Rods-Wire-Cold Drawn Carbon Steel Rounds-Electrolytic Tin Plate-Coke Tin Plate-Pipe and Tubular Products-Sheets - Plates - Conduit - Tie Plates and Spikes.

RUSTLESS DATA SHEET NO. 7

Corrosion Resistance Plus Strength at Sub-Zero Temperatures

One of the Many Combinations of Properties Offered by Stainless Steels



Applies to types: 301, 302, 304, 309, 316, 321, and 347.

OPERATION of aircraft in the extreme cold of the stratosphere has placed more and more emphasis on engineering materials exhibiting high resistance to shock loads at temperatures many degrees below zero Fahrenheit. Also, equipment for handling liquefied gases such as oxygen, nitrogen, and hydrogen must operate at even lower temperatures . . . in the vicinity of —400° Fahrenheit. Ordinary steels have not been found suitable for essential working parts operating at such extremely low temperatures. They suffer material loss of toughness and become increasingly brittle as temperatures drop below zero.

At normal temperatures the austenitic or chromium-nickel stainless steels have extremely high toughness values—higher than any standard engineering alloy. As temperatures are reduced, a remarkable property of the austenitic stainless steels becomes apparent . . . toughness is further increased at sub-zero temperatures. Impact tests performed at reduced temperatures have indicated a continuous increase in toughness all the way down to —400° Fahrenheit. The results of some of these tests are shown on the above chart. Highest izod impact values are naturally obtained on annealed material, but even with material cold worked to 250,000 psi tensile strength, it is possible to obtain over 40 ft. lbs. izod impact strength at —80° Fahrenheit.

The chart does not include Rustless 18-8 FM, Type 303, which is the free-machining counterpart of Type 302. However, both the sulphur and selenium bearing grades of Type 303 exhibit proportional increases in toughness with decreasing temperatures even though their initial impact strengths are somewhat lower than that of Type 302. Thus, valve parts to be machined on automatics and subjected to extremely low-temperature service can be made of Rustless 18-8 FM, Type 303 and outstanding performance can be expected.

Stainless steels offer many other desirable properties to designers: Strength and resistance to scaling at extremely high temperatures, durability, stiffness, sales appeal and, above all—economy. They are remarkably versatile everyday engineering materials. Many grades have been developed to fit varying service requirements and fabricating conditions. Rustless' specialized experience in stainless steels can help you select the proper grade for your purpose. Consult our technical service staff.

Yes, there are many grades of stainless steel. While they are commonly referred to by A.I.S.I. type number, some mystifying trade names are used. Therefore, to aid users in correlating trade names, type numbers and the principal Government Specifications we offer our helpful publication "Trade Names of Stainless Steels." Write for your copy today.

Rustless

DIVISION OF ARMCO

RUSTLESS IRON AND STEEL DIVISION
THE AMERICAN ROLLING MILL COMPANY
Baltimore 13, Maryland
STAINLESS STEEL SPECIALISTS

Why the Wire Industry Prefers the MEAKER PROCESS

for Electro-Galvanizing Wire

● The Meaker Process for electro-galvanizing wire has demonstrated its positive supremacy over other wire-coating methods throughout years of successful operation in many of America's leading wire plants of all sizes. Here are a few reasons why Meaker Process plants — engineered to the requirements of the user — give the best possible results at the lowest possible cost:

1. Coats high carbon or low carbon steel without impairing physical properties.
2. Coats wire of any type, grade or size — any quantity.
3. Uniform coating, full protection from corrosion — no thin spots.
4. Perfect adhesion — no cracks on bending wire.
5. Exact control of coating thickness at all times.
6. Simple operation — easily learned — requires little skill.
7. High-speed operation — faster than other methods.
8. Permits faster drawing of wire.
9. Versatile — fits many applications.
10. Guaranteed economy, regardless of size of plant.

MAKES HUNDREDS OF PRODUCTS BETTER

Meaker Process wire has proved best for countless products, including: Coat hangers — wire baskets — soap holders — bed fabrics — springs — nails — rivets — chain link fence — ornamental fence — cable clips — wire rope — wire forms . . .

Write to us, and let us explain the process and how it applies to your own requirements.

THE MEAKER COMPANY

1629-1641 South 55th Avenue (Cicero Station)
CHICAGO 50, ILLINOIS

ANNOUNCING . . .

a Sensational NEW abrasive

THE GREATEST DEVELOPMENT SINCE NORTON INTRODUCED THE ORIGINAL FUSED ALUMINA ABRASIVE (ALUNDUM) IN 1901!

32 Alundum*

It's an entirely new type of aluminum oxide abrasive — made differently by a Norton-invented and Norton patented process.

Each grain is a single, complete crystal — individually produced in the electric furnace — not crushed to size.

Each crystal is strong and solid in shape and with many sharp points for faster, cooler cutting.

Stock wheels for surface, tool and internal grinding available now — other types soon.

Write for additional information or, better still, call in your Norton abrasive engineer or Norton distributor.

NORTON COMPANY • WORCESTER 6, MASS.

Cuts deeper and faster

Cuts freer without burning

Requires fewer dressings

Gives longer wheel life

NORTON ABRASIVES

* Trade mark reg. U.S. Pat. Off.

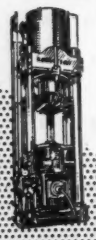
. . . like the name of Stradivarius
in a world of music . . .

THE NAME OF ROBERTSON MEANS HIGHEST QUALITY

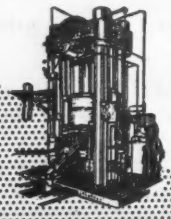
The fine, rich tone of perfectly seasoned wood, shaped accurately for inspired melodic reproduction, bespeaks to the music world the matchless artistry of a Stradivarius. Just so, in the field of hydraulic engineering, the name of Robertson stands for outstanding performance, unmatched craftsmanship, highly-skilled engineering.

Robertson Equipment is practically tailored for the job required . . . assurance of complete satisfaction. Robertson are designers and builders of Lead Encasing Machines, Hydraulic Equipment including Extrusion Presses, Hydraulic Pumps, Melting Furnaces and Pots, Die Blocks, Dies and Cores, Hydro-Pneumatic Accumulators, Lead Sheath Stripping Machines and Special Equipment for Special Uses.

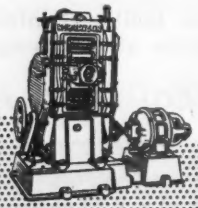
HOSE LEAD ENCASING PRESS



CABLE LEAD ENCASING PRESS

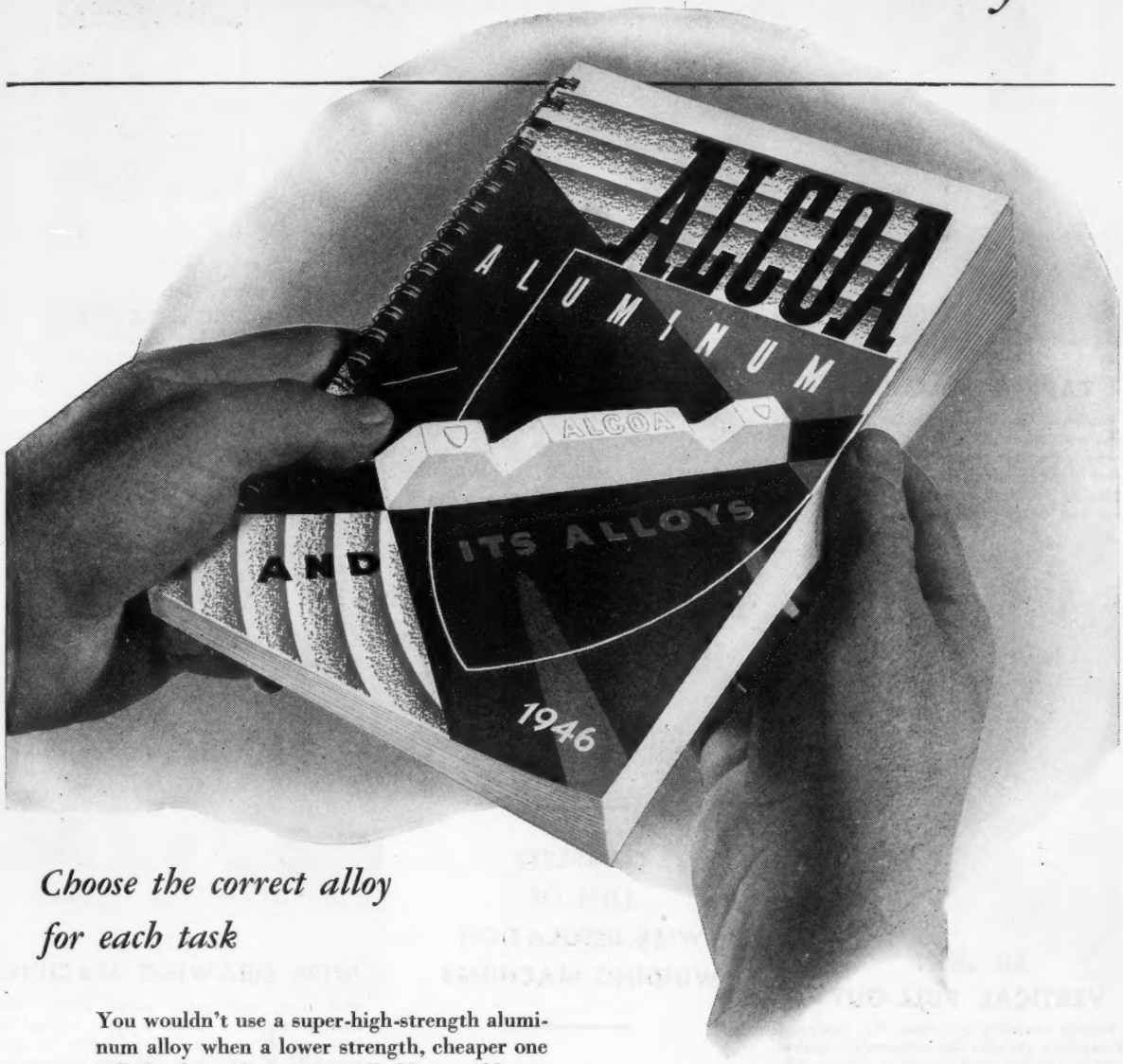


LEAD SHEATH STRIPPING MACHINE



JOHN Robertson
COMPANY, INCORPORATED
125-135 WATER STREET, BROOKLYN 1, NEW YORK
Designers and Builders of all Types of Lead Encasing Machinery
Since 1858

Alcoa Aluminum IS A LOT OF *Alloys*



Choose the correct alloy for each task

You wouldn't use a super-high-strength aluminum alloy when a lower strength, cheaper one will do the task just as well. Nor would you employ an alloy that's especially designed to withstand outdoor exposure when all it's asked to do is "look pretty" at some inside location. And so on—

You spend less money when you're correctly advised on the selection of materials. Which is where Alcoa engineers fit into the picture. Calling on their years of experience in developing, testing and fabricating aluminum alloys, they are usually able to say, "That's the alloy to use." You get into production without delay.

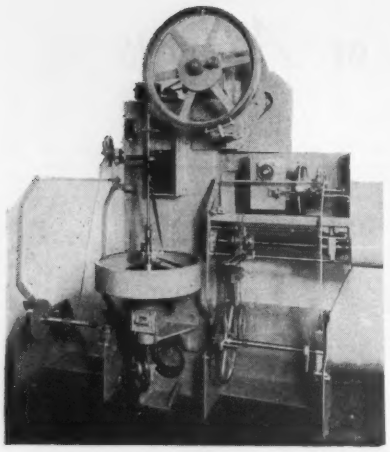
To help you select aluminum for the usual jobs, Alcoa offers the book, "Alcoa Aluminum and its Alloys." For a free copy, write:

ALUMINUM COMPANY OF AMERICA, 1828 Gulf Building, Pittsburgh 19, Pennsylvania.

ALCOA FIRST IN **ALUMINUM**

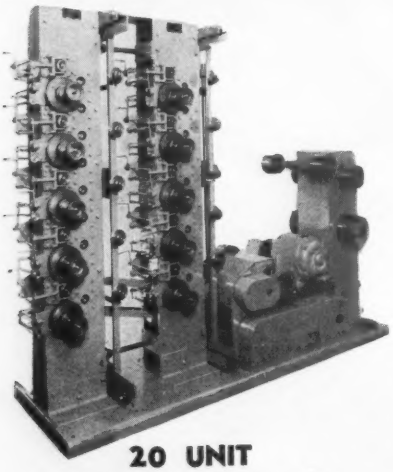
REG. U. S. PAT. OFF.

ALCOA ALUMINUM



TAPING MACHINE

For Varnished Cambric and other tapes. Pads of tape are concentric mounted on dynamically balanced reversible head, arranged to give constant tape tension. Welded steel frame, ball-bearing mounted, adjustable traverse on take-up and motor drive.



20 UNIT VERTICAL PULL-OUT

For tinning, annealing processes, etc., equipped with capstans, clutches for independent control of spool spindles and speed variator. Ball-bearing mounted and motor driven. Low height for ready accessibility.

EST. 1855 AIMCo INC. 1915

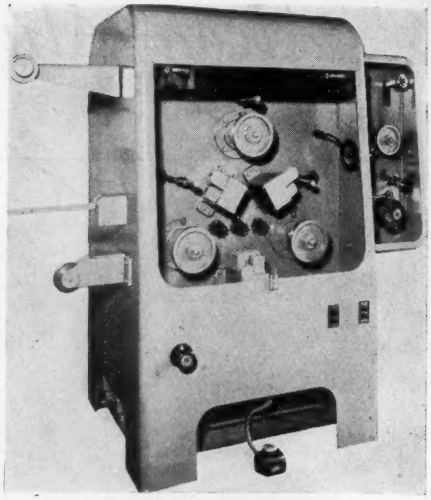
"American" INSULATING MACHINERY COMPANY

REG. U.S. PAT. OFF.

517 West Huntingdon St.
Zone 33

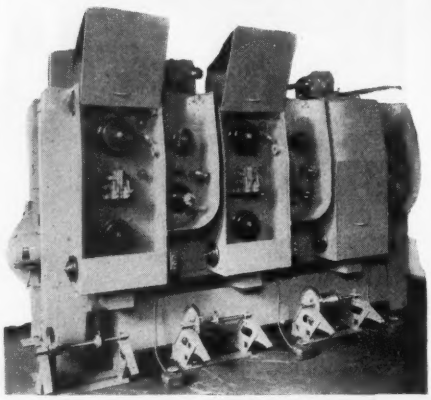
PHILADELPHIA PENNSYLVANIA U.S.A.

COMPLETE LINE OF WIRE INSULATION WINDING MACHINES



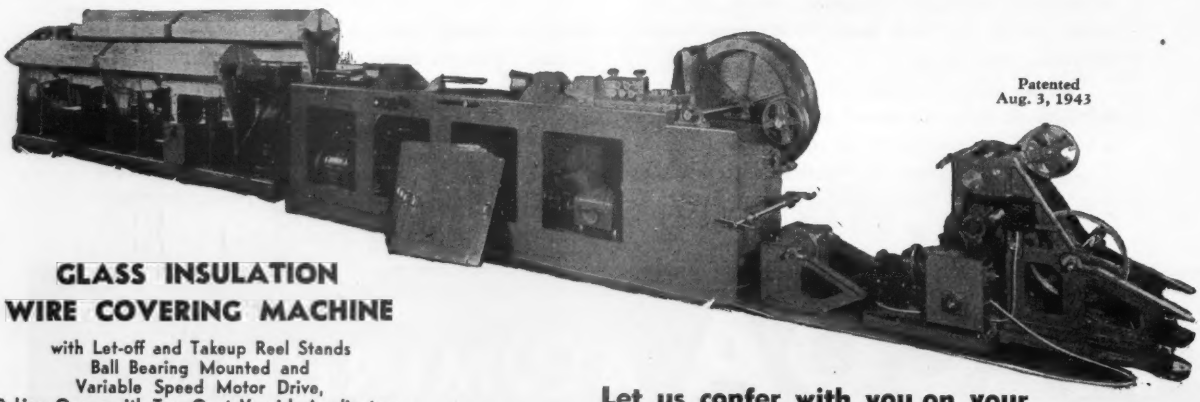
HIGH SPEED WIRE DRAWING MACHINE

for Intermediate and Fine Wire



3 UNIT WIRE DRAWING MACHINE

With units individually motor driven, ball-bearing mounted, positive spool control on take-ups. A combination of units to give versatility of product in fine and intermediate wires simultaneously.

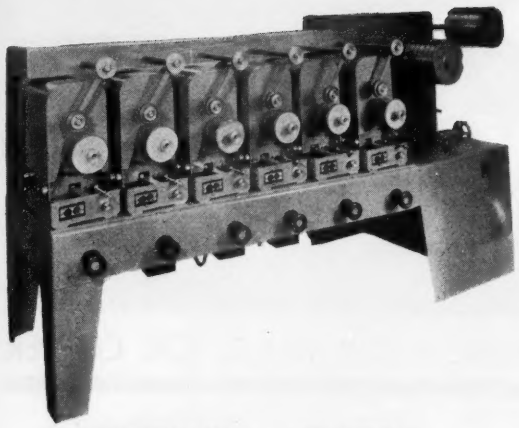


Patented
Aug. 3, 1943

GLASS INSULATION WIRE COVERING MACHINE

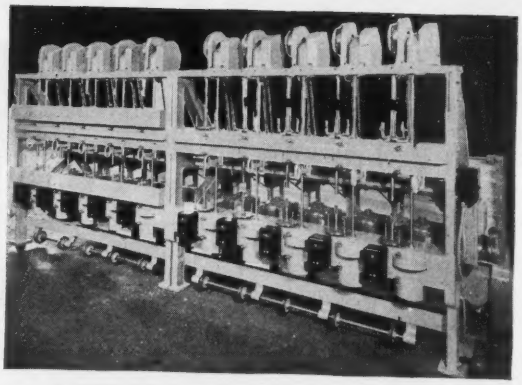
with Let-off and Takeup Reel Stands
Ball Bearing Mounted and
Variable Speed Motor Drive,
Baking Ovens with Two Coat Varnish Applicators,
and Individual Automatic Temperature Controllers.

Let us confer with you on your wire machinery problems



HORIZONTAL MULTIPLE WIRE PULL-OUT

Each spool unit traverses independently and is driven by a separate torque motor. Capstan also driven by separate motor through speed variator. Ball-bearing mounted. Ideal for ribbon wire.



MODEL 2D10-MBB MACHINE

High speed, ball bearing, each unit individually motor driven for Application of all types of insulation spirally wound.

EST. 1855 AIMCO INC. 1915

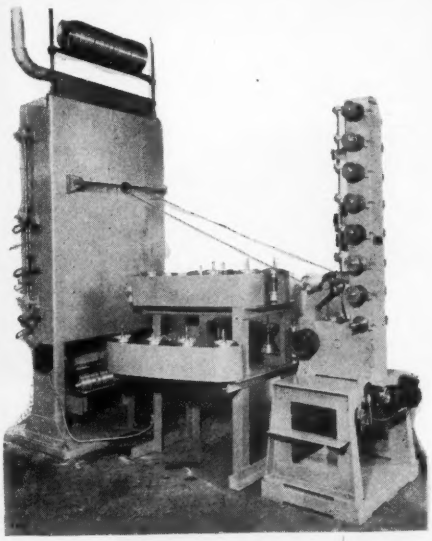
"American" AIM INSULATING MACHINERY COMPANY

REG. U.S. PAT. OFF.

517 West Huntingdon St.

Zone 33

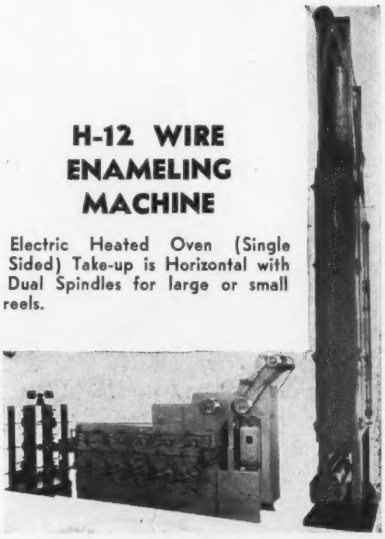
PHILADELPHIA PENNSYLVANIA U.S.A.



S-16 MEDIUM WIRE ENAMELING MACHINE

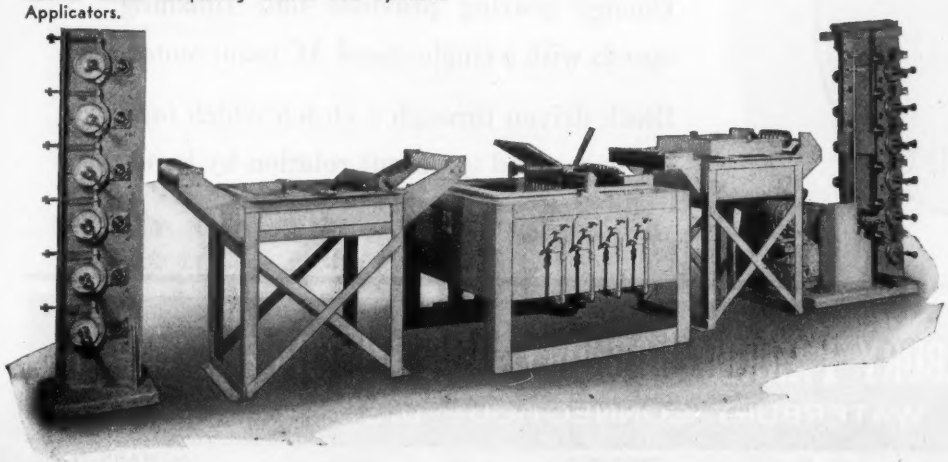
Ball-bearings and Motor Drive. Other models for heavier wires. Lacquering Outfits and Synthetic Applicators.

FULL LINE OF WIRE ENAMELING MACHINES



H-12 WIRE ENAMELING MACHINE

Electric Heated Oven (Single Sided) Take-up is Horizontal with Dual Spindles for large or small reels.



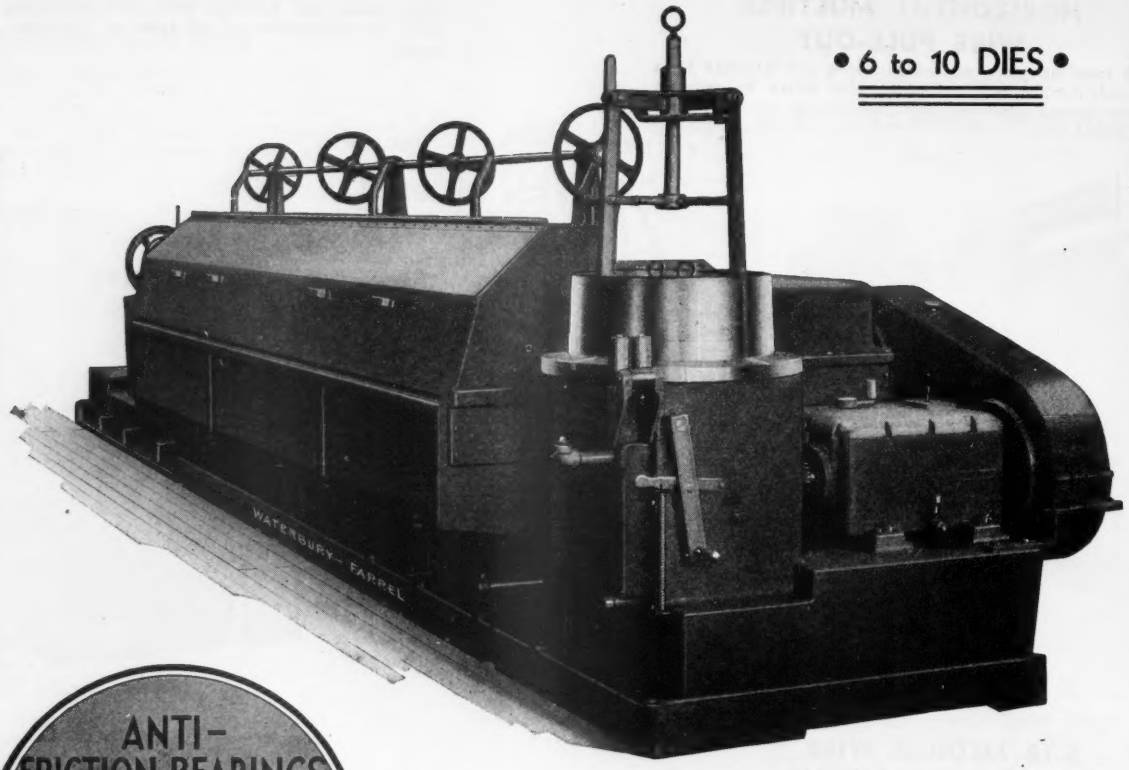
WIRE TINNING OUTFITS

Horizontal Takeups and Let-offs supplied for larger size wires and accommodating large reels.

WATERBURY-FARREL

NO. 1 TANDEM WIRE DRAWING MACHINE – FOR BRASS OR COPPER

• 6 to 10 DIES •



ANTI-FRICTION BEARINGS
FORCED FEED LUBRICATION
SPIRAL BEVEL GEARING

Change gearing provides four finishing speeds with a single speed AC main motor.

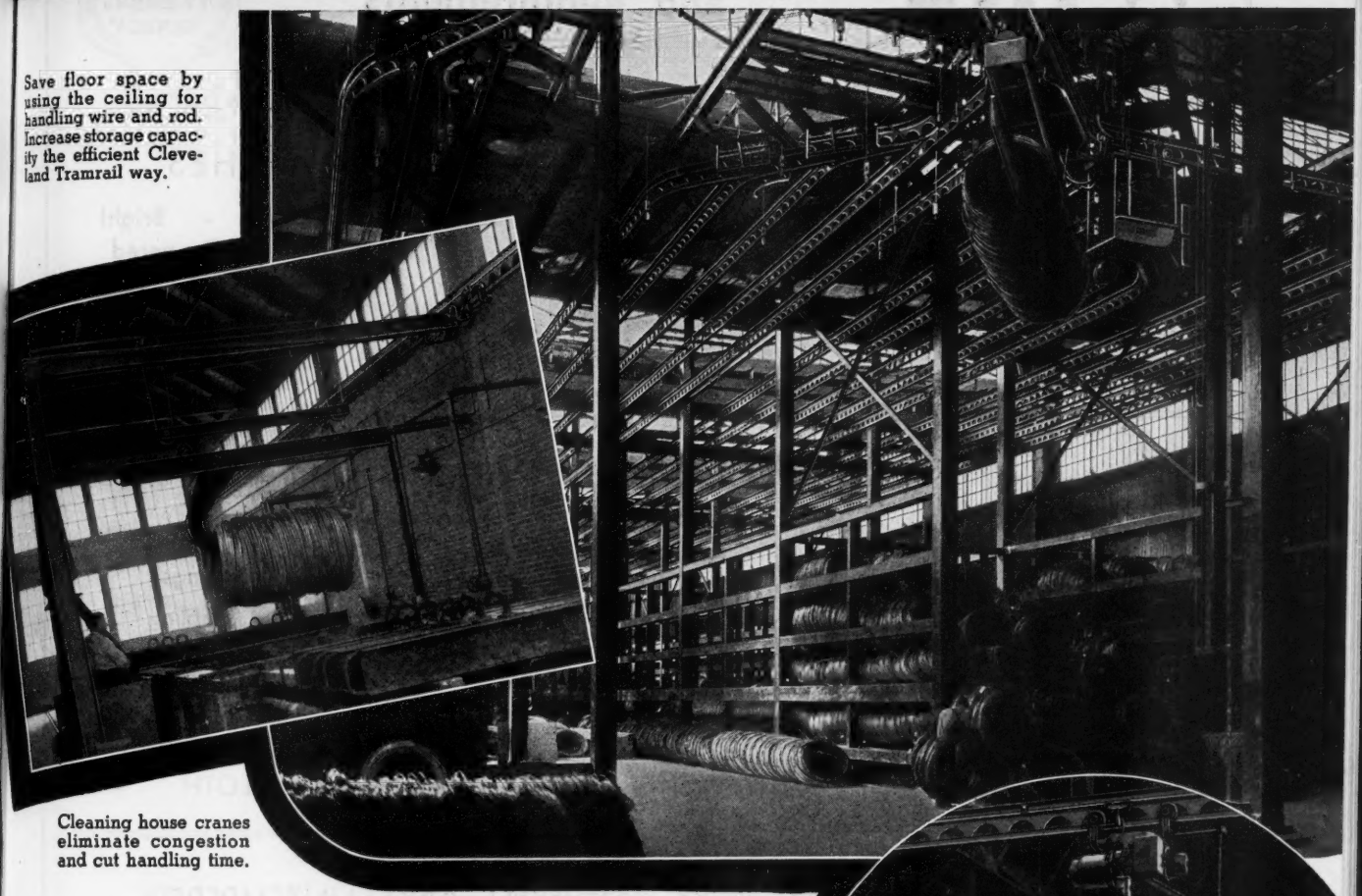
Block driven through a clutch which may be disengaged to permit rotation by hand.

THE WATERBURY FARREL FOUNDRY AND MACHINE COMPANY

WATERBURY, CONNECTICUT U.S.A.

CLEVELAND CHICAGO NEWARK, N. J.

GREATER PRODUCTION *Without* PLANT EXPANSION



Save floor space by using the ceiling for handling wire and rod. Increase storage capacity the efficient Cleveland Tramrail way.

Cleaning house cranes eliminate congestion and cut handling time.

In these days when greater and greater production is called for in mills and plants drawing and fabricating wire and rod, Cleveland Tramrail offers a real solution.

Without plant expansion or new building construction your production can be greatly stepped up by modern Cleveland Tramrail methods. Equipment is available for every department.

Cleaning house cranes, block-stripping cranes, hairpin hook carriers and other Cleveland Tramrail equipment streamline the operations, accelerate the production flow, eliminate waste effort and cut costs.

Don't remain hampered! Investigate Cleveland Tramrail. Learn what is being done by others, large and small. Many installations to study.

Cleveland Tramrail is the leading supplier of block-stripping and carriers for both internal and external stripping.

CLEVELAND TRAMRAIL DIVISION
THE CLEVELAND CRANE & ENGINEERING CO.
1141 East 283rd St. Wickliffe, Ohio

CLEVELAND TRAMRAI

WIRE for Practically All Purposes and Requirements

IRON — STEEL — LOW CARBON — HIGH CARBON

SHAPES

Square - Keystone - Flat
Round - Half Round - Special
Shapes - Straightened
and Cut

Tempered and Untempered

FINISHES

Liquor Finish - Bright
Galvanized - Coppered
Enameled All Colors
Annealed - Tinned
Oil Tempered

FOR

Belt Hooks
Binding - Bonnets
Bookbinders
Brooms - Brushes
Clips - Cotter Pins
Florist - Glass Wire

Grape Tying
Hair Pins
Hooks and Eyes
Link Fabrics
Lock Washers

Mattresses
Pins
Special Springs
Ropes - Stapling
Stone Wire
Tags -- Weaving

* * *

• FLY SCREEN WIRE CLOTH • GALVANIZED HARDWARE CLOTH •

* * *

HIGH CARBON FLAT WIRE TEMPERED AND UNTEMPERED

Gutter Broom
Square

Curtain Spring
Snap Spring
Bobby Pin — Flat & Half-round

Lock Spring
Fish Tape

LOW CARBON

Cotter Pin

Box Stitching

Bookbinders

Highest Quality and Service Guaranteed

* * *

ESTABLISHED 1905

The Seneca Wire & Mfg. Company

Fostoria, Ohio

Representatives and Warehouses in principal cities

Four Red Letter Days . . .

october

1946

sun	mon	tue	wed	thur	fri	sat
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

. . . In a Red Letter Month

NOT only will the four days of the Annual Convention of the WIRE PRODUCTS INDUSTRY prove helpful in the mutual interchange of "run of shop" information and ideas; but the entire month bids fair to stand out as a **red letter period** among the many strenuous months that have preceded.

Much troubled water has passed over the dam and the time should be auspicious of better days ahead. We therefore look forward with special confidence and high hopes to meeting you at the coming Convention of '46.

Standardize with Standard

STANDARD INDUSTRIAL COMPOUNDS COMPANY

4600 W. Ferdinand Street, Chicago 44, Ill.

Standardize with Standard

VASCOLOY–RAMET

Tantalum / Tungsten

CARBIDE DIES

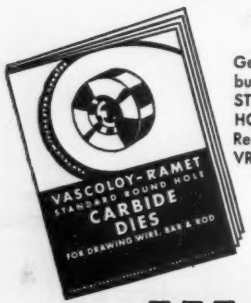
For

DRAWING WIRE BAR and ROD

NOTE TAPERED NIB AND CASING
Front and back openings in the new type casing permit easier inspection due to greater visibility.

- Easier to Work
- Greater Strength
- Time and Material Saver
- Better Lubrication
- Full Visibility

Maintain size longer and produce better finish. Tantalum/Tungsten Carbide has a lubricating characteristic which greatly reduces mechanical resistance in drawing, and in so doing, enables a much smoother finish. Many mills report longer productive life, less down time, greater tonnage per die and greater operator satisfaction. Write us for informative Bulletin VR348.

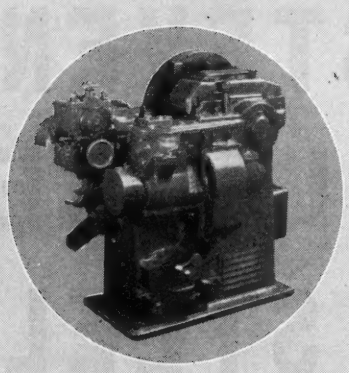


Get this helpful bulletin on STANDARD ROUND HOLE DIES. Request Bulletin VR348.

VASCOLOY Ramet RAMET CORPORATION

AN AFFILIATE OF FANSTEEL METALLURGICAL CORPORATION AND VANADIUM ALLOYS STEEL COMPANY

NORTH CHICAGO, ILLINOIS • SALES AND SERVICE IN PRINCIPAL CITIES



THE NEW NATIONAL COLD HEADER

has been adopted by over 200 Producers. They are the Who's Who of the Bolt and Rivet Industry.

These ultra-modern machines are available in single and double blow, solid and open die, and short and long stroke.

There are over 50 types and sizes.

NATIONAL

MACHINERY COMPANY

TIFFIN, OHIO

New York Detroit Chicago

"STEVENS FLANGED STEEL TRAVERSES"

WRITE US CONCERNING YOUR TRAVERSE REQUIREMENTS AND PROBLEMS.

TRAVERSES — 8" TO 56" IN DIAMETER
6 1/2" TO 48" IN TRAVERSE
10 Ga. TO 18 Ga. MATERIAL
HOT DIP GALVANIZED, PLAIN
OR PAINTED FINISH.

THE STEVENS METAL PRODUCTS CO.

NILES, OHIO

Talide
(TUNGSTEN CARBIDE)

Performance!

Talide Out-Performs Steel Die 25 to 1 on 5" Alloy Steel Tubing

Here's a recent production report from one of America's largest mills.

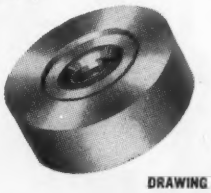
Using a Talide Die instead of a steel die on a cold drawbench, this concern produced 252,000 feet of 5" alloy steel tubing, as compared with the normal run of 10,000 feet with a steel die . . . a production advantage of 25 to 1.

This performance is not phenomenal with Talide. Made from the hardest metal known, Talide Dies stay on the job many times longer than any high speed steel. "Down time" practically disappears, enabling you to establish and maintain profitable continuous production. Scrap and rejections offer no problem because Talide Metal eliminates pickup, scoring and scratching. Equally important, with such products as tubing, these mirror-like dies impart a much higher finish.

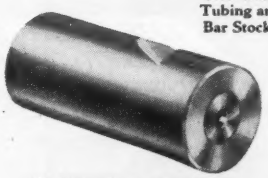
Talide Metal is a real cost-cutter. Write for Bulletin No. 43-WP or ask one of our Talide engineers to stop in and show you how you can produce more for less with Talide Metal.

TALIDE METAL
MEETS EVERY REQUIREMENT

SHEET METAL DIES
(For Deep Drawing Metal Products)



DRAWING DIES
(For Wire, Tubing and Bar Stock)



HEADING AND EXTRUSION DIES
(For Shaping and Sizing Bolts, Nuts, Screws, and Rivets)

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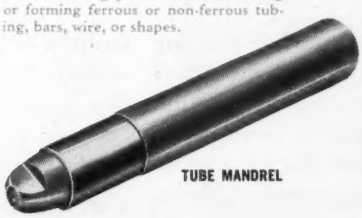
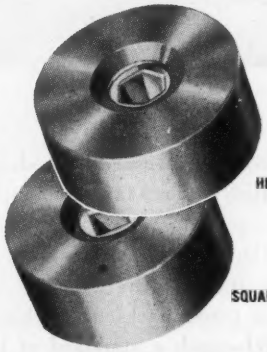


TUBE MANDREL



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The well-earned reputation for quality which these three companies have enjoyed will be maintained in the new and greater Colorado Fuel and Iron Corporation.

CF&I

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The Colorado Fuel and Iron Corporation

THE CALIFORNIA WIRE CLOTH CORPORATION

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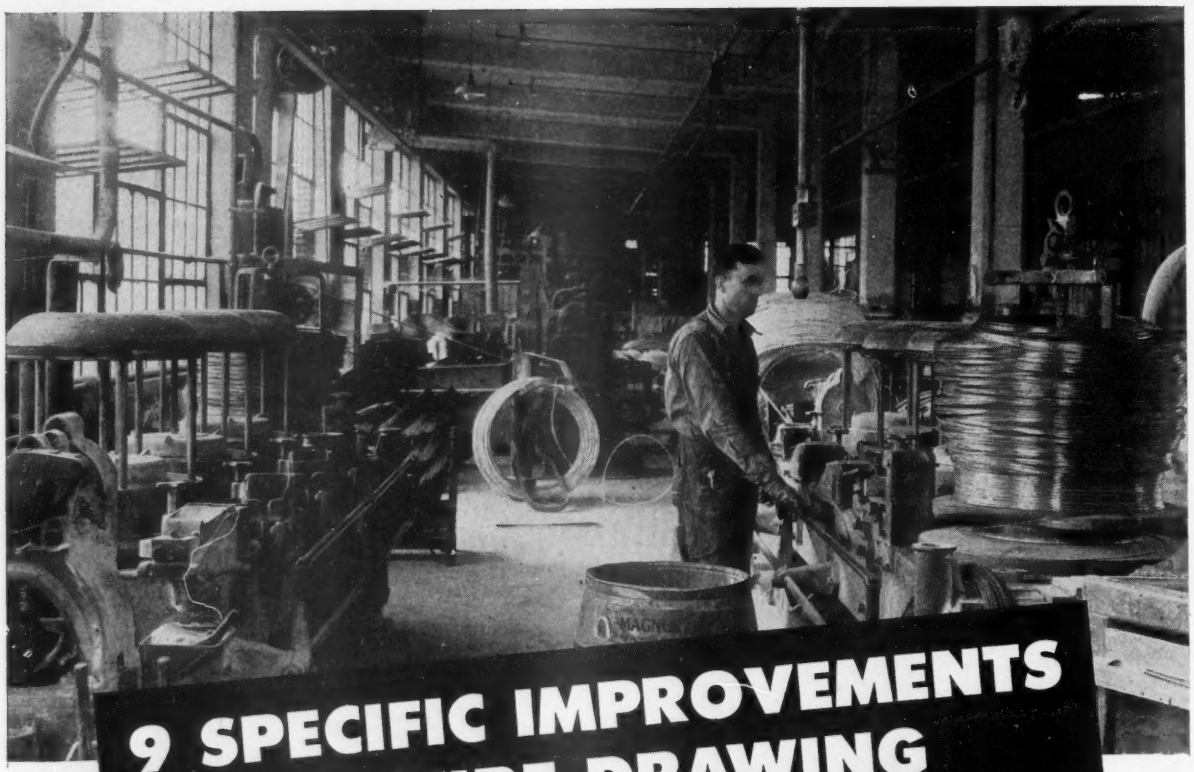

9 SPECIFIC IMPROVEMENTS IN WIRE DRAWING

Here are the definite improvements in your drawing operations you can confidently expect when you stop using lime and replace it with time- and performance-tested

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1. **Better finish** on any wire, particularly on stock drawn for special finishes.
2. **Reduced rejects** caused by off-size wire or scratching.
3. **Better rust-proofing** than heretofore possible.
4. **Reduced lubrication costs** (up to 50%) due to lean lubrication involved.
5. **Hydrogen embrittlement is eliminated** right in the coating solution.
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MAGNUS CHEMICAL CO., 188 SOUTH AVE., GARWOOD, N. J.

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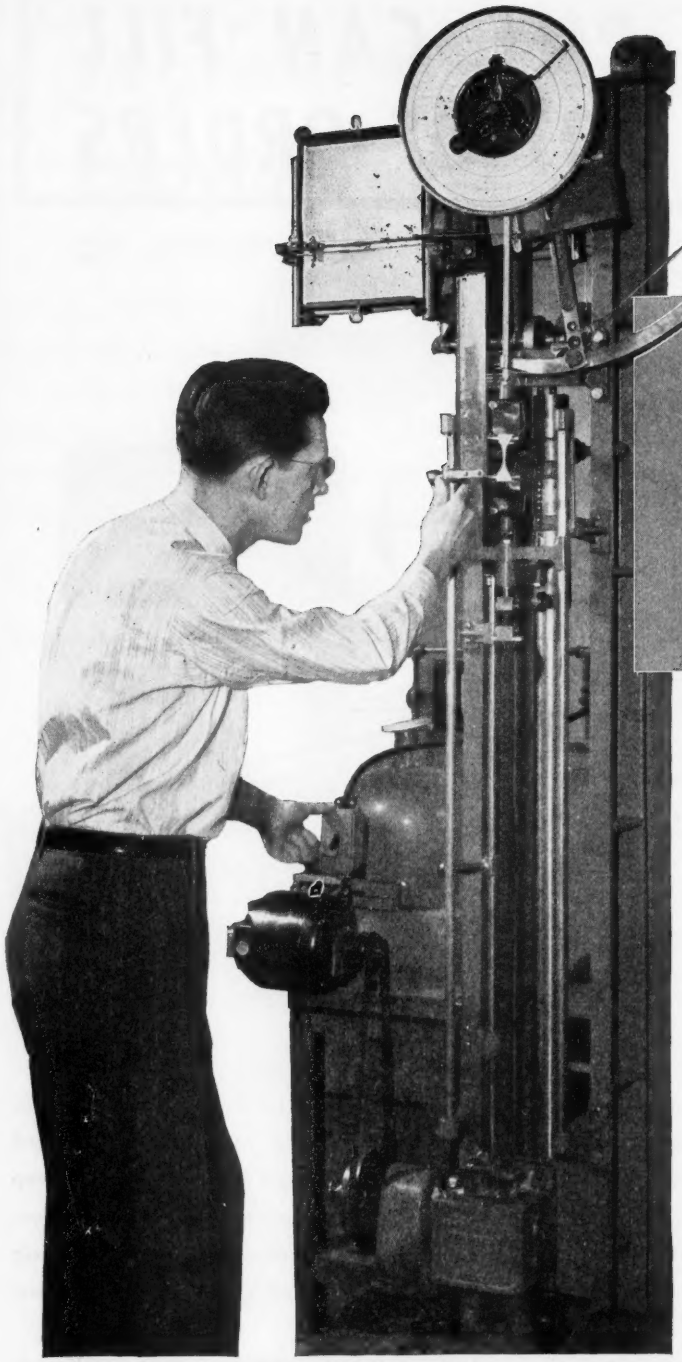

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● For close to 50 years G.E. has been developing cable tapes to meet the most exacting requirements.

Constant experimentation produced the durable varnish that gives the tape its high dielectric strength and high-quality, long-staple cotton yarn containing just the right amount of sizing to permit maximum varnish impregnation.

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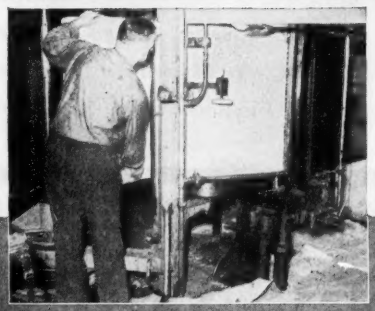
Make your cable a "Top" cable and use G-E cable tape to keep it "Tops". For further details write to Section RIMA-WP, Resin and Insulation Materials Division, Chemical Department, Schenectady, N. Y.



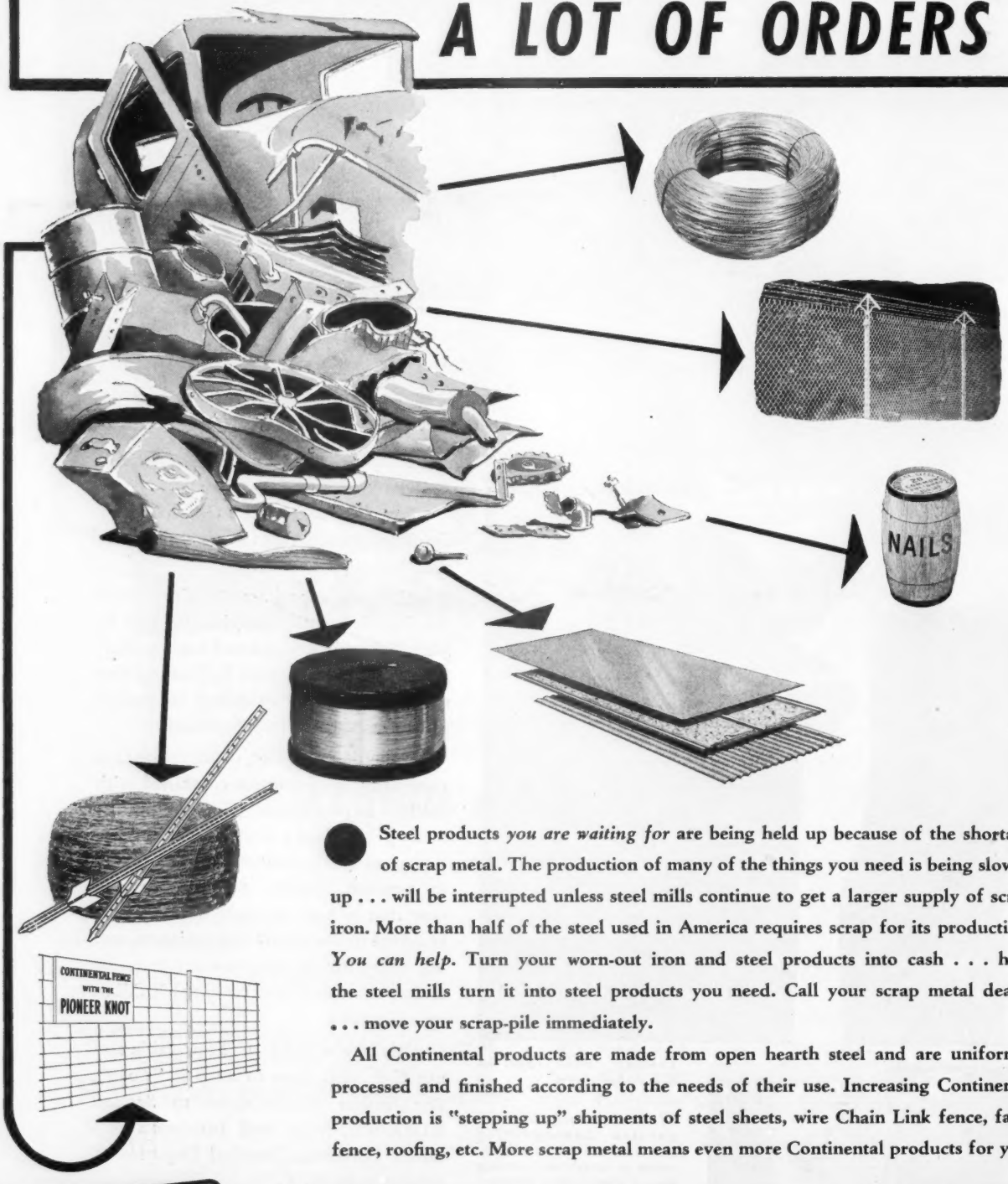
Testing cable tape in G-E laboratory.

Cloth starting through varnish impregnating machine where it will receive a uniform coating under controlled temperatures.

GENERAL ELECTRIC

CD46-T3

YOUR SCRAP-PILE CAN FILL A LOT OF ORDERS



Steel products *you are waiting for* are being held up because of the shortage of scrap metal. The production of many of the things you need is being slowed up . . . will be interrupted unless steel mills continue to get a larger supply of scrap iron. More than half of the steel used in America requires scrap for its production. *You can help.* Turn your worn-out iron and steel products into cash . . . help the steel mills turn it into steel products you need. Call your scrap metal dealer . . . move your scrap-pile immediately.

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CONTINENTAL STEEL CORPORATION

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ALSO, Manufacturer's Wire in many sizes, shapes, tempers, and finishes, Continental Chain Link Fence, Nails, and other steel products.

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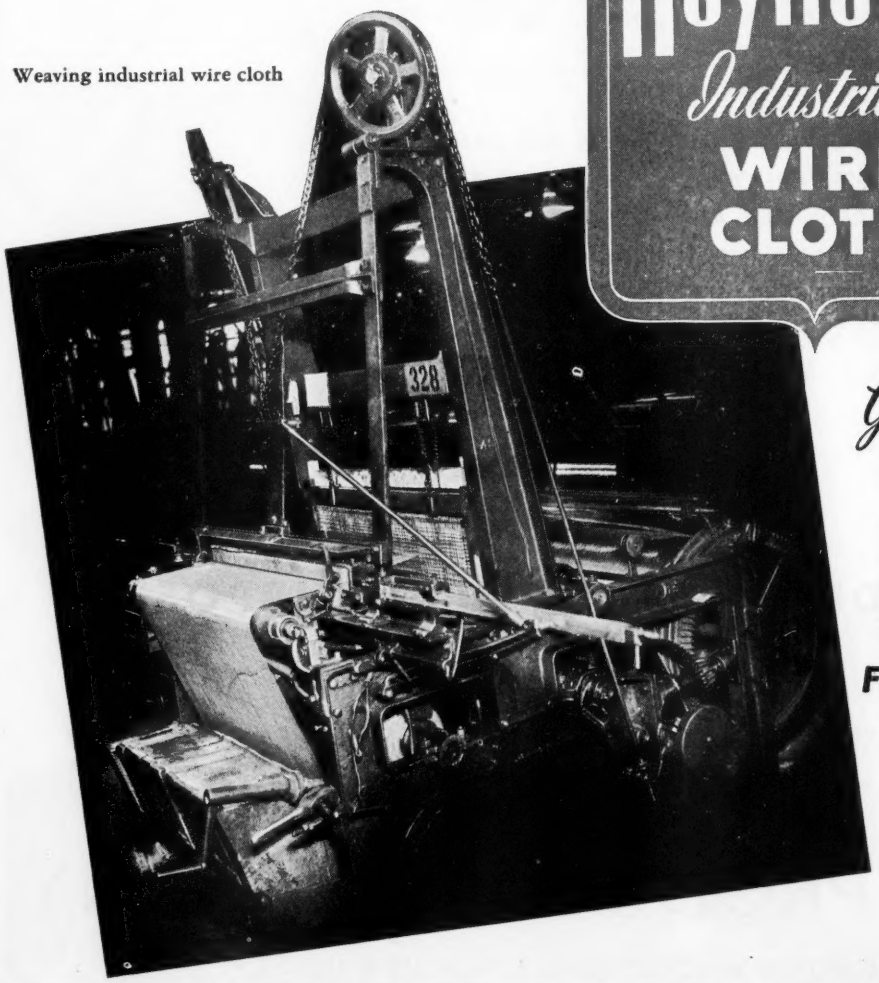
Weaving industrial wire cloth



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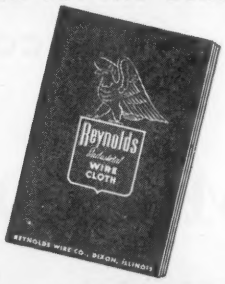

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If you make it of WIRE *make it of the best!*

. . . And the best wire for you, of course, is the wire that will help you put your product out in front in a competitive market. Whether you make bicycles or birdcages, bolts or nails, tire chains or corn poppers, there is a U·S·S American Manufacturers Wire that will meet your needs precisely.

When you specify U·S·S American, you get more for your money in three ways:

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3. **Service**—Our specialists are always at your service—gratis—to help you select and use the wire best suited to your purpose.

Today is none too soon to begin giving your product the benefit of the best steel wire money can buy. Write for a free consultation.

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Lower Your Material Handling Costs . . .

Hubbard steel drums make reel assembly easy . . . no need for jigs . . . no time-wasting aligning of wood stays. Heads bolt directly to strong, light-weight drum to form rigid, durable reel.

Above is shown quick, 4-bolt attachment of heads to Hubbard 8″ by 12″ diameter drum. Below right are shown various sized drums, assembled reel, and spooled reels ready for shipment of 7/16″, 6x19 wire rope. Use Hubbard drums to decrease your handling and shipping costs on cable and related products. Write for complete information and list of sizes.

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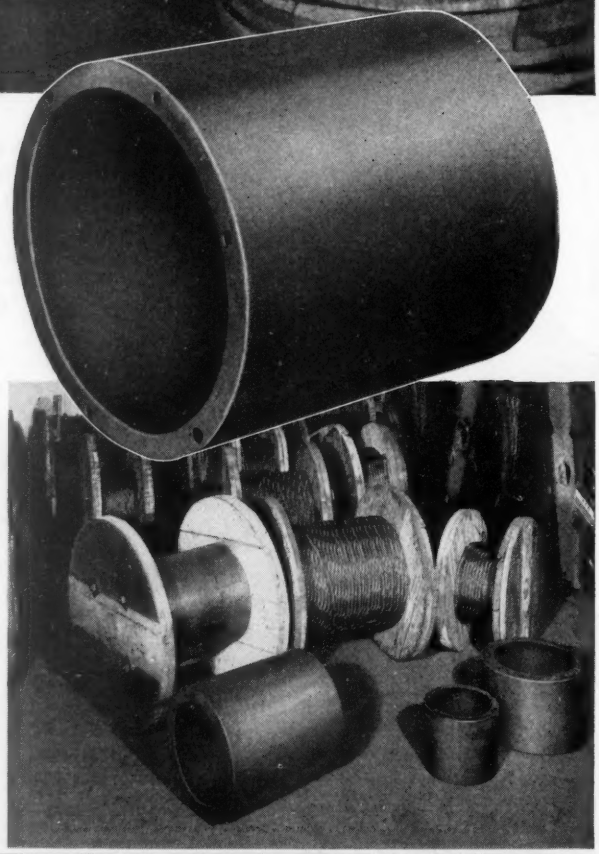
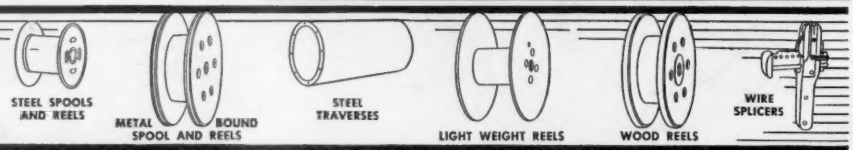


Hubbard



SINCE 1912 MANUFACTURERS OF WIRE DRAWING · ANNEALING · SHIPPING SPOOLS AND REELS

To meet your requirements

If it can be wound on a reel, spool or bobbin, Apco Mossberg can fill your needs.

For over 50 years we have specialized in the manufacture of spools and reels of all kinds. Our plant is fully equipped with modern machinery to manufacture almost any conceivable kind, type and size of steel spool, reel and bobbin, in large quantities or small.

All inquiries are first referred to a fully staffed Engineering Department, where your requirements are carefully analyzed, and a product recommended—or designed—to satisfy your needs exactly. From start to finish a rigid inspection system guarantees a product uniform in size and quality.

A Service Department is maintained, and we will gladly send a representative to your factory to assist in any problem involving reels, spools or bobbins.

An interesting brochure, recently published, gives considerable useful information, illustrating and describing a few score of the various Apco Mossberg spools and reels that find the largest application in industry today. Write for a copy.

APCO MOSSBERG COMPANY
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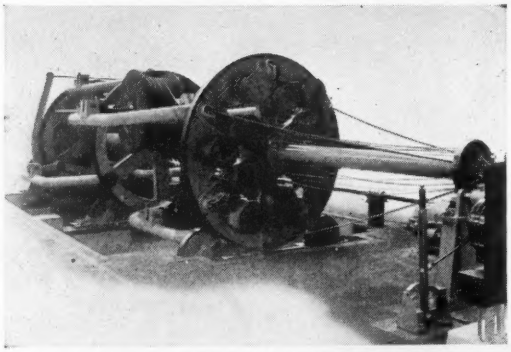
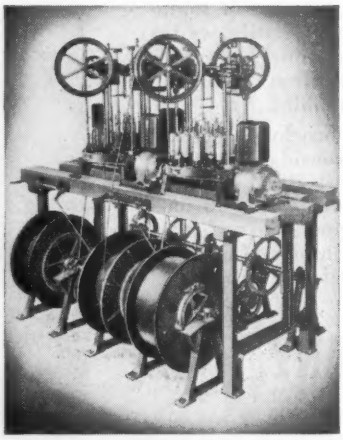
WIRE MACHINERY

NEW ENGLAND BUTT COMPANY EXTENDS GREETINGS
TO THE MEMBERS OF THE WIRE ASSOCIATION

Whether you require a cable closing machine or a small braider, the New England Butt Company can supply you with a machine to suit your needs.



CABLE CLOSING MACHINE



BRAIDERS

"Butt" engineers are always willing to discuss your problems with you and make recommendations to help you manufacture your product more economically.

We offer a complete line of wire machinery.

Why not put your wire problems up to us?

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LITZENDRAHT AND
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There's more to present day engineering and design problems than shortages of materials, priorities, etc. There is also the question of whether specifications have been rigidly adhered to. Wire, for example, must meet such requirements as specific electrical properties, flexibility, tensile strength, laying speed, uniformity, etc.

Whether it's a buyer's or seller's market, WINCO magnet wire products are drawn to exact specifications. Uniformity of product is guaranteed by mercury process tests and careful supervision guards against variations in consistency, structure or electrical values.

If you have a wire problem, our complete facilities are at your disposal. Send blueprints or specifications for recommendations, without obligation. Samples sent on request; write today.

WINSTED DIVISION

WINSTED HUDSON WIRE COMPANY CONNECTICUT

THE *Trauwood* PROCESS IS SETTING A NEW "WIREBOUND" TRADITION!!

QUALITY, UNIFORMITY, LOW-COST OPERATION

★ The electric resistance heating used in our process is over 90% efficient and results in a uniformly heat treated product plus the ability to duplicate exact heating and quenching cycles from day to day.

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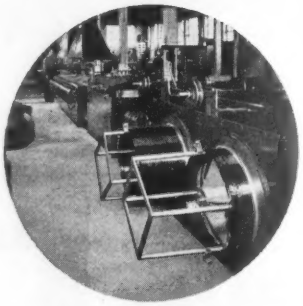
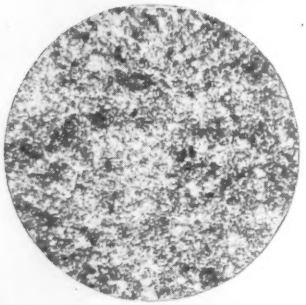


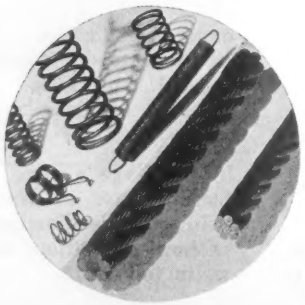
★ The TRAUWOOD process is much faster than ordinary furnace heating due to the very rapid rate of electric resistance heating. The equipment is entirely automatic and is easy to operate. Greater production with a material reduction in pickling and cleaning costs is insured.

BROAD THERMAL RANGE ACCURATE CONTROL



★ The finer grain produced by TRAUWOOD electric resistance heating develops the maximum physical and fatigue properties in any steel in either patenting, tempering or annealing. The annealing of stainless steel and other alloy wire and strip is readily accomplished since the high quenching temperatures necessary are easily and rapidly attained.

CAN BE DESIGNED FOR ALL SIZES AND TONNAGES



★ The TRAUWOOD process, in addition to doing a better wire heat treating job, is opening new fields of application for the wire industry. The equipment is designed to meet your specific requirements and can be built to handle all sizes in any tonnage required. Full information will be furnished on request.

THE TRAUWOOD ENGINEERING COMPANY

WESTERN RESERVE BUILDING • • • • CLEVELAND 13, OHIO

The Wire Outlook

The brief encouragement aroused by the acknowledgment on the part of certain labor leaders and administration spokesmen that the wage increases granted last Spring had failed of their purpose, was dashed to earth when in September the teamsters and maritime unions were called out.

For a while it had begun to look as though there might be a drawing of intelligence in people and places where it might do some good. This may still be so, but there seems to be little question that the September strikes were Communist sponsored, and intended primarily to embarrass private enterprise by keeping it from functioning smoothly for any considerable period of time. Such strikes are aimed at free enterprise and are part of a studied campaign by Moscow, or its agents trained there, operating with the connivance and protection of traitors to Americanism in high places, themselves either of pinkish or worse or just plain politicians, willing to sell our birthright for votes.

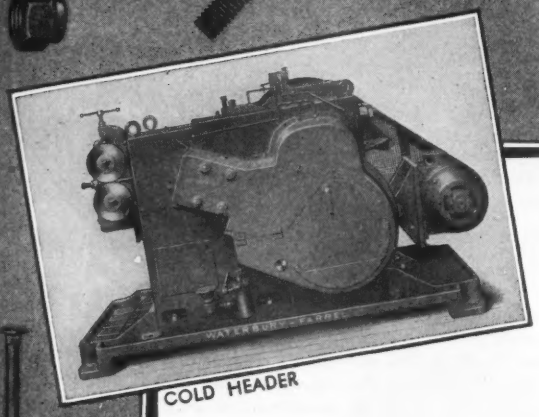
That strikes have benefitted nobody—least of all labor—is simple provable fact. Industry cannot afford higher wages without hiking prices to cover, unless the output per man-hour is so improved that basic costs are definitely lowered. At present price levels the last estate of labor is worse than the first, if current purchasing power of wages is compared with that of 1945. In the automotive industry a campaign has been started by labor itself to increase production efficiency, and it is expected that this move will be extended to other industries. The thorn in our flesh, both from labor and management's standpoint is going to be the activities of the Communists, who will be doing everything within their power to upset the economic applecart. Government could help to clean out these noisome agitators and revolutionists, but probably won't. On the rank and file of labor, good sound Americans, most of whom are forced into membership by strong-arm methods, falls the chief responsibility for housecleaning. May they have the courage and the wisdom to accomplish it, for if they don't, it will not be long before they become the abject tools of a foreign ideology.

Would that our country could have in this hour of crisis a real leader—honest, fearless, impartial and both able and determined to live up to his oath of office, the Bill of Rights and the Constitution! Let this be noted: the American Public is long-suffering and not easily stirred to action. If pushed too far, its collective wrath and might will rise to stamp out the pests that now beset us.

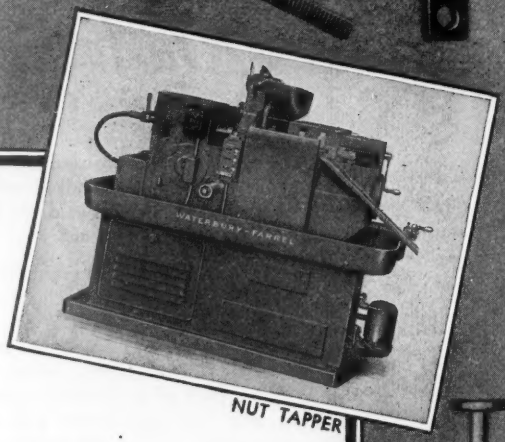
This is the month in which the Wire Industry foregathers for its Annual Convention. The occasion offers opportunity for those who make wire and wire products and for those who serve them to become better acquainted, to exchange technical and management ideas, to refresh old friendships and to make new ones. The fact that our economy has not functioned too well in the first of the post war years will make desirable a free exchange of views on the specific problems with which each may be confronted. You who attend are urged not to be backward about either seeking the counsel of your neighbors within the industry or in giving freely of your experience if your counsel is sought.

We are anticipating an exceptionally fine session this year in Buffalo and take this opportunity to extend to all members and their guests a most cordial welcome to the Seventeenth Annual Convention of the Wire Association.

—from the Editor's Desk



COLD HEADER

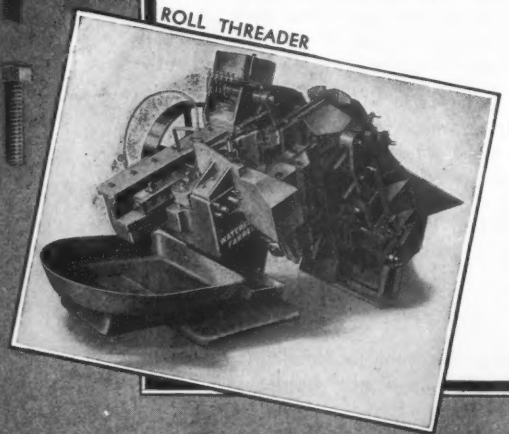


NUT TAPPER

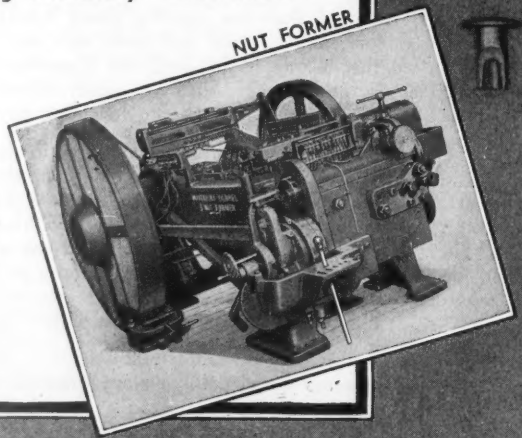
THE VARIETY of bolts, screws, nuts and numerous other products of similar nature which can be produced from the coil, economically and to accurate size by the cold process, is almost limitless.

WATERBURY-FARREL, pioneer in this line of automatic machinery, is well-qualified by many years of experience to help solve your cold-heading problems and to furnish efficient machinery to meet your every need.

ALSO, Power Presses, Wire Drawing Machinery, Rolling Mills, and accessory metal-working machinery—since 1851.



ROLL THREADER



NUT FORMER

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WIRE AND WIRE PRODUCTS

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DRAWING — ROLLING — EXTRUDING — FORMING — FABRICATING

Vol. 21 OCTOBER, 1946 No. 10

Designated as
Official Publication By The Wire Association

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Publication Office: New York, N. Y.
Executive Office: Stamford Trust Co. Bldg., 300 Main St., Stamford, Conn.

Annual Subscription, U. S. $5.00, Canada $5.00

50 Cents a Copy in U. S. Issued Monthly Foreign, $7.50

October Convention Issue $1.00 a Copy
January Convention Discussions Issue $1.00 a Copy

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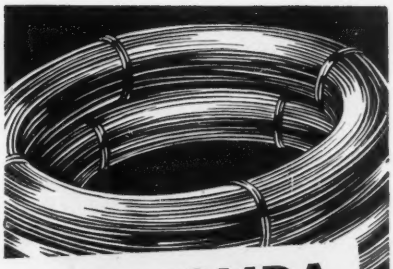

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DRAWING — ROLLING — EXTRUDING — FORMING — FABRICATING

Vol. 21 OCTOBER, 1946 No. 10

Demineralized Water in the Wire Mill

By Dr. F. R. Morral

Metal Trades Laboratory
Technical Service & Development Division
American Cyanamid Company
Stamford, Conn.

THE title of this paper may strike you as somewhat unusual. However, consider if you will, the thousands of gallons of water required daily by the metal mills for heating and cooling purposes, and smaller amounts for cleaning, pickling, rinsing, plating, wet drawing, liquor coating, porcelain enameling and for chemical analysis in the laboratories. The main concern is generally the effect of the water on conduit pipes, machinery and other property so that they may not be damaged. Little or no thought is usually given as to the effect of water on the material which is your end product.

* * *

MOST of us will agree that it is of advantage to use pure water in the laboratory for chemical analysis. Some of you make your own distilled water, others buy it. In the last few years a new process for producing pure water has been developed. This is known as demineralizing and will be discussed later. We have indicated the importance of the purity of water in the laboratory. Of equal importance is the purity of the water in some of your processes which require larger amounts of water. Some problems I recall in the mill were, wires which after drawing were difficult, nay, impossible to clean after the local water came in touch with the thin film of lubricant remaining on the wire. At the time the subject was not explored nor investigated. The drawing soap was thrown out. Experiments using distilled water would have been expensive and hardly feasible at the mill then. Today small demineralizing units, Fig. 1, connected to any tap, will give a continuous flow of pure water, and an investigation of the effect of water in a certain operation becomes practical in any mill at a moderate cost. Results obtained by comparing the local water supply with the same demineralized may have surprises in store for many of us

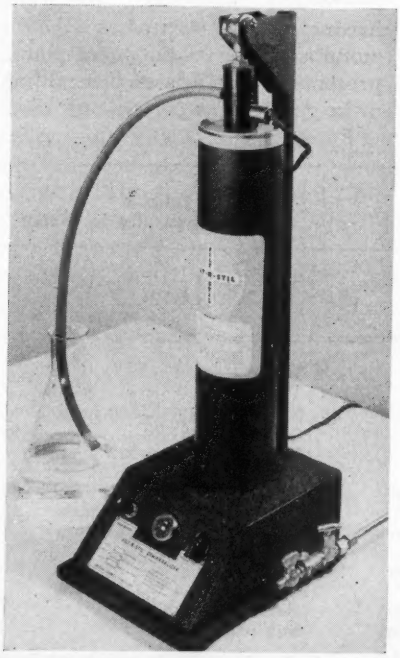

Figure 1. A cartridge demineralizing unit (removal capacity equivalent to 500 grains of calcium carbonate).

* * *

* * *

SOME years ago, on operating a pilot electroplating unit for wire, undesirable plates were obtained soon after starting a run. The plating solution was made up with distilled water. The rinsing of the pickled wire, before coming into the plating tank was done with ordinary water, as was the rinse after plating. Rinsing with distilled water before plating since no small commercial demineralizing units

were available immediately showed improvement in the type of plate obtained. After drying the wire was streaked. Use of distilled water after the plating remedied the undesirable appearance. The same may possibly be true for wire after hot galvanizing, hot tinning, after quenching and/or washing. I recall that problems often came up in the Wet Drawing department. Next time, you may find it worthwhile to check your water there. We all will be interested in your results.

* * *

THERE is no use repeating what has been written in various articles on the problems which can be avoided in cleaning and in rinsing if impurity-free water be used in the make-up of aqueous cleaning solutions (1,2,3,4). Similar warnings (3-9) have been issued to the electroplater in the make-up of his aqueous plating solutions and rinses for the finished product. Increased production and lowered rejects in the electroplating or anodizing of aluminum products (2,4) by the use of water of zero hardness after alkaline cleaning has been discussed. The porcelain enameling industry (10) is aware of the effect of water in the preparation of metal and recommends use of steam condensate.

* * *

PLATING solutions are particularly sensitive to impurities which may be of 2 kinds: suspended and dissolved. Most of the suspended impurities can be eliminated by filtration. They generally cause porosity of the plate, roughness and treeing of deposits. It is desirable to avoid the introduction of dissolved impurities from salts, anodes, and water by adopting specifications for them. The effect of various impurities on several common electroplating solutions has been shown (9). Frequently it has been found that very small amounts, only parts per million, of a constituent in a bath has a decided effect. It must be recalled that water makes up the great bulk of the plating bath, 70 to 90% by weight.

* * *

PLATING efficiency is closely related with the pre-treatment of metals, the last operation of which is rinsing. Blistering, poor adhesion, tarnished and possibly spotty deposits may be directly attributed to a disregard of this step in the sequence of plating operations.

Water

THE water technologist has a language of his own. For example, he talks about temporary hardness, permanent hardness, and total hardness. He expresses the amounts of the various compounds present in ppm (parts per million) or in gpg (grains per gallon) where 10 gpg = 171 ppm = .0171% of the total composition. The impurities found in water and the maximum amounts determined are listed in Table I.

* * *

TODAY demineralized water, in solids content as low as distilled water, can be made available as readily, and nearly as cheaply, as ordinary tap water without distillation. The process is almost as simple as filtration. The materials used to demineralize water are generally certain synthetic resins having remarkable ion-exchange characteristics. Several articles have been written on the reactions occurring between the resins and the salts, considered as anions and cations, in the water. Only one is listed for reference purposes (12).

* * *

IN brief, the ion-exchange resins are of two types — one is a cation-active material, and the second is an anion-active material. Water containing sodium chloride (common table salt), for example, is filtered through a bed of hydrogen-activated cation resin; the resin takes sodium to form sodium resin and gives up its hydrogen which with the chloride forms dissociated hydrogen chloride. The water containing the latter then flows on through an anion resin bed where the hydrogen chloride is absorbed by the resin, and water

Table I
Possible Impurities in Water

A. In Solution

I. Inorganic

Cations		Anions	
Hydrogen		Bicarbonates)	— 982 ppm
Ammonium		Carbonates)	
Aluminum		Chlorides	— 552 ppm
Calcium	— 210 ppm	Flourides	— 1 ppm
Copper		Nitrate	— 57 ppm
Iron (+A1)	— 51 ppm	Nitrate	— 66 ppm
Magnesium		Silicates as SiO_2	— 82 ppm
Manganese	— 4 ppm	Sulfates	—1199 ppm
Potassium	— 52 ppm	Sulfides	
Sodium	— 332 ppm	Sulfites	

II. Organic

Salts — Acids

B. In Suspension

Clay
Colloidal matter
a) Inorganic — silica
b) Organic — Albumen
Dirt
Rust
Silt
Phosphate

Notes: 1. The impurity is expressed in ppm of the ion.
2. Values given are maximum found in latest published survey of U. S. Waters (11). The maximum total solids found may be over 1800 ppm.
3. Surface waters may contain a high percentage of organic matter.

partly or entirely free of sodium chloride results. By analogous reactions, the same resins will remove part or all of any mineral salt from water.

* * *

WHEN the ion-exchange resins are exhausted, they are easily reactivated by simply passing a dilute acid solution through the bed of cation resin and a weak alkali through the anion bed, an easy procedure which can be provided for in the apparatus. Ultimate replacement with new resins is due only at long intervals; some units have been in steady use without renewal for many years.

* * *

A single system of cation and anion exchange resins is called a two-bed system (Fig. 2). Fig. 3 indicates the removal of $C0_2$ and Fig. 4 indicates stabilization of pH by such a system. A disadvantage of this system is leakage of ions, lack of pH control and presence of $C0_2$ in the effluent.

* * *

FOR greatest efficiency, the four-bed system has been developed (Fig. 5), whereby the influent flows successively through cation, anion, cation and anion resin beds. The properties of water are also shown in Figs. 3 & 4. Water treating engineers evaluate the quality of water by determining its electrical resistance, since the lower the solids content of water, the greater is its resistance to the flow of electricity. For example, a certain raw water had a specific resistance of 3,000 ohms. After passage through a two-bed system a single cation and a single anion resin bed, it had a peak resistance of 70,000 ohms. When demineralized by the four-bed system, its peak resistance rose to 1,500,000 ohms. Its solids content had been reduced from the original 346 parts per million to 2 parts per million! This is a degree of demineralization more than adequate even for exacting experimental work in plating laboratories.

* * *

IN these four-bed type demineralizing units (Fig. 5) a conductivity cell keeps watch over the resistance of the effluent, actuates a signal light or an automatic shut-off so that only water of the desired standard will be drawn off.

* * *

EQUIPMENT is available commercially, in units having a flow rate from 10 gallons per hour (Fig. 1, 6, 7 & 8) to over 100,000 gallons per hour. The latter are specially constructed units.

* * *

ANOTHER experience to illustrate the effect of demineralizing water may be cited. Recently, a manufacturer of plating solutions made experiments with copper cyanide baths using regular tap water and demineralized water. The solutions made up with the latter gave brighter deposits comparing favorably with "bright" copper plate.

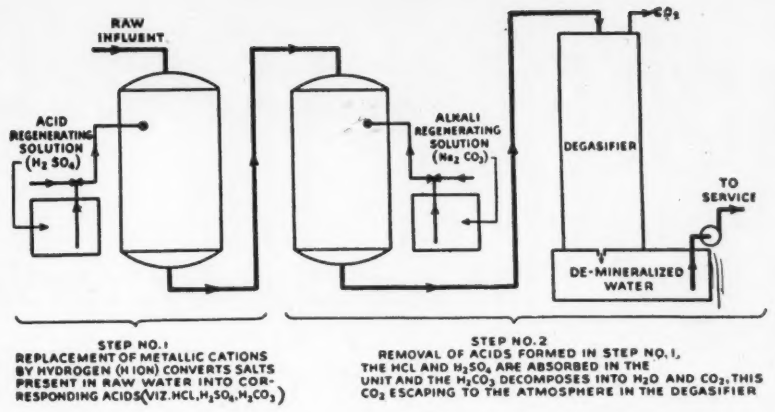
RAW INFLUENT
ACID REGENERATING SOLUTION (H_2SO_4)
ALKALI REGENERATING SOLUTION (Na_2CO_3)
CO_2
DEGASIFIER
TO SERVICE
DE-MINERALIZED WATER
STEP NO. 1
REPLACEMENT OF METALLIC CATIONS BY HYDROGEN (H ION) CONVERTS SALTS PRESENT IN RAW WATER INTO CORRESPONDING ACIDS (VIZ. HCL, H_2SO_4, H_2CO_3)
STEP NO. 2
REMOVAL OF ACIDS FORMED IN STEP NO. 1, THE HCL AND H_2SO_4 ARE ABSORBED IN THE UNIT AND THE H_2CO_3 DECOMPOSES INTO H_2O AND CO_2, THIS CO_2 ESCAPING TO THE ATMOSPHERE IN THE DEGASIFIER

Figure 2. Two step process for demineralizing water.

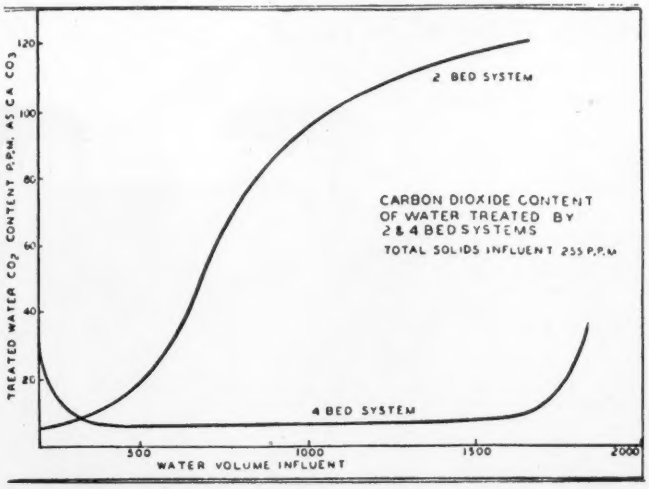

Figure 3. Carbon dioxide removal in 2 and 4 bed systems.

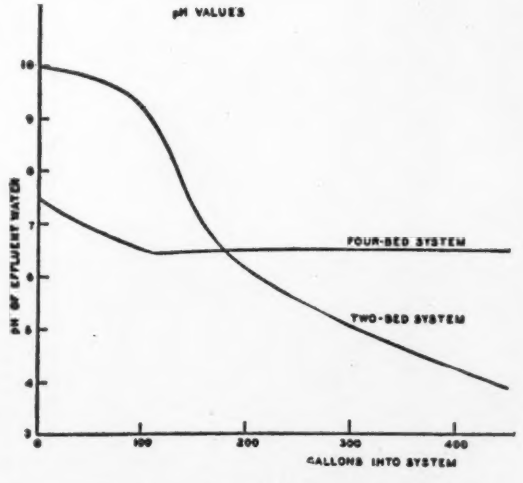

Figure 4. pH of water effluent from 2 and 4 bed systems.

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The models illustrated are suitable for drawing a complete range of sizes starting from rods or wire and finishing down to fine sizes. Finishing speeds depend on the size and grade of wire.

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No Slip Can Occur

The Morgan-Connor Machine operates on the storage principle. This principle permits the wire to be uncoiled from each block as required from the succeeding block. As the wire is *uncoiled* rather than *unwound* no slip can occur.

Completely Air-cooled

Air-cooling removes the heat from the wire, preserves the coating and maintains lubrication —thereby increasing the life of the dies. Air-cooling permits drawing both low and high carbon products at high speeds — preserving the physical properties of high carbon wire.

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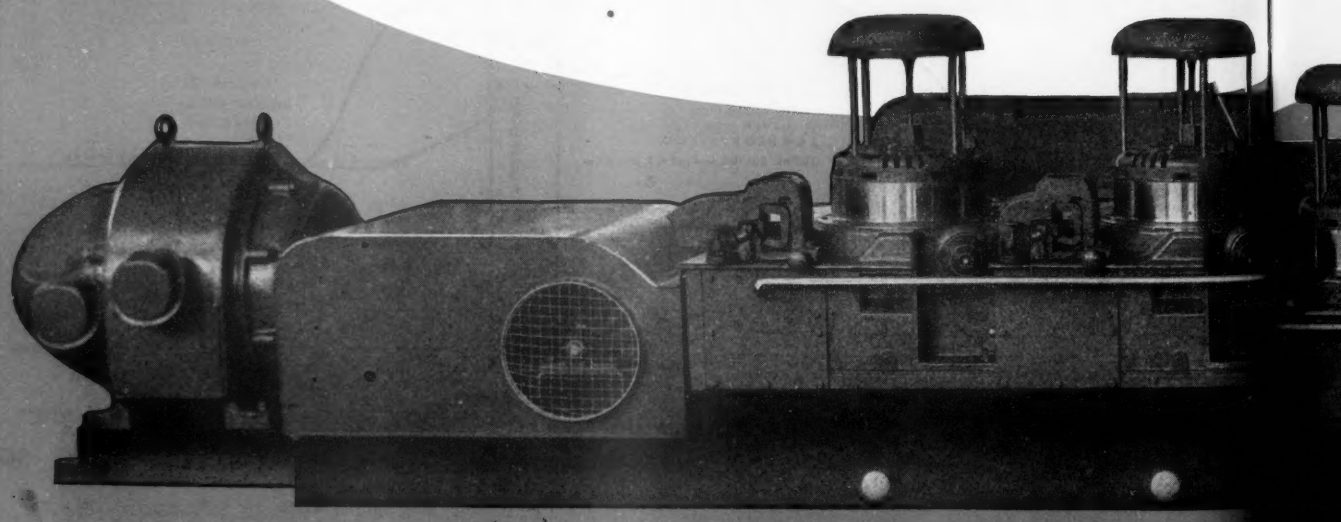

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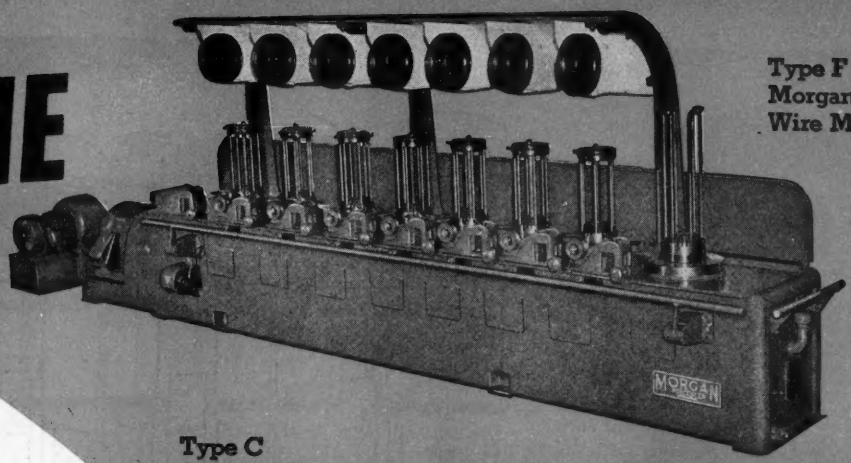
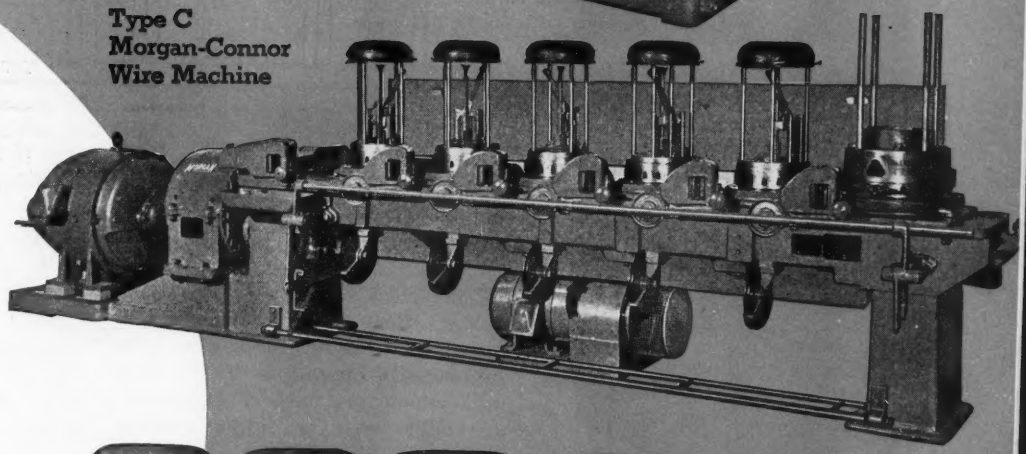


Type F
Morgan-Connor
Wire Machine

Type C
Morgan-Connor
Wire Machine



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Low Die Cost

Low Space Requirement

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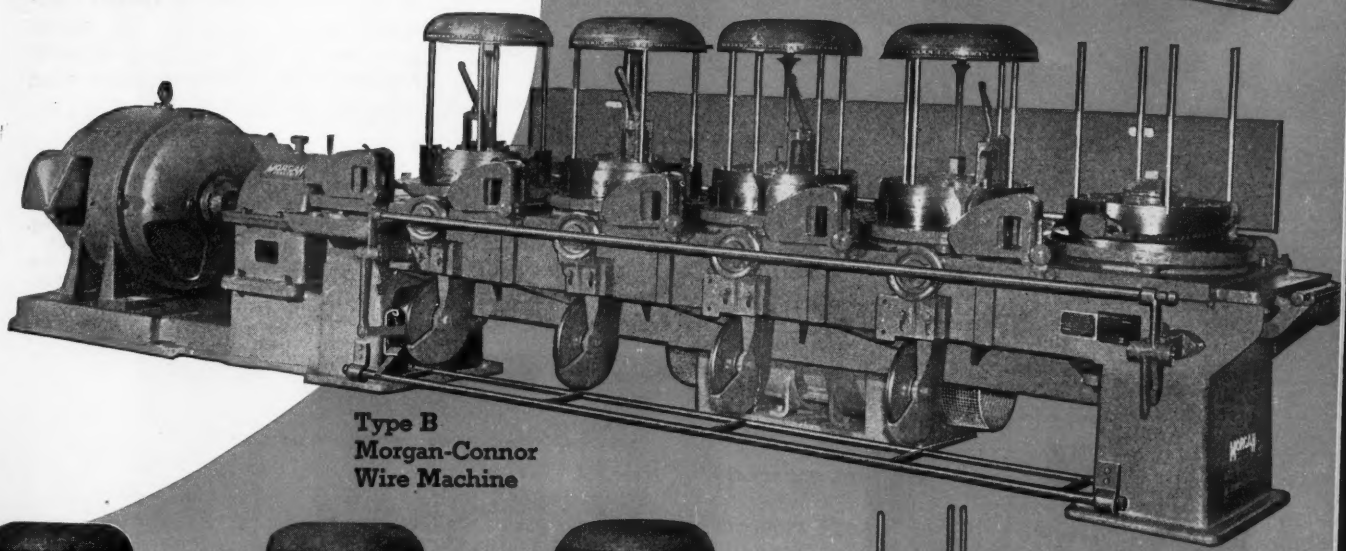
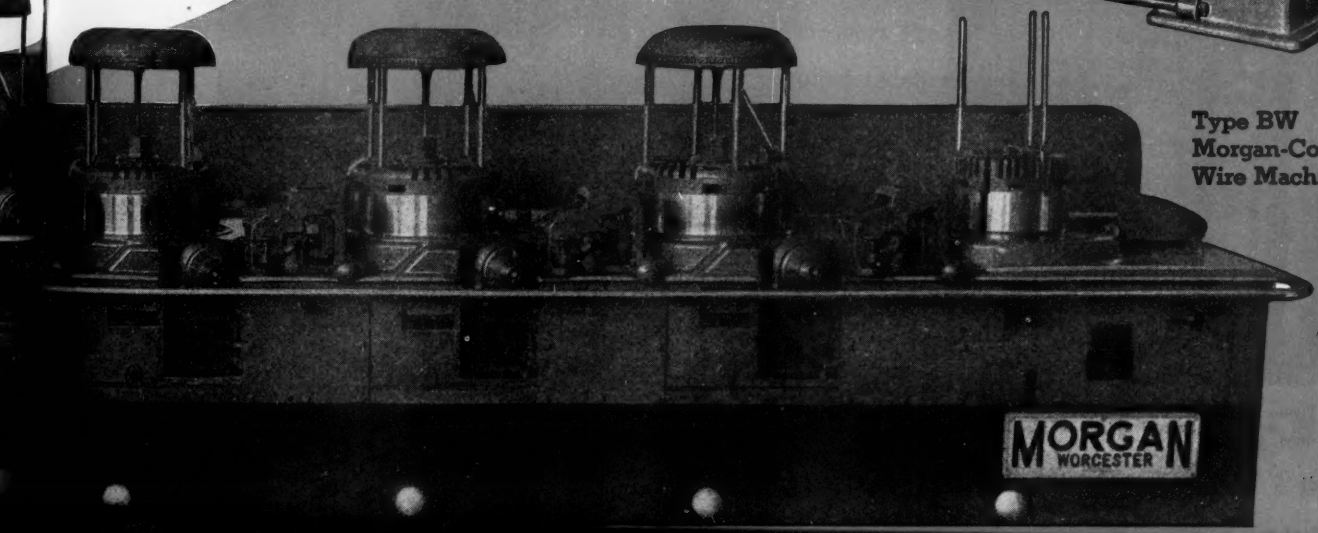


Type B
Morgan-Connor
Wire Machine



Type BW
Morgan-Connor
Wire Machine

Figure 6. A double cartridge demineralizing unit (capacity 1200 grains). ★ ★ ★

SEVERAL demineralizing units are already in operation in the mirror silvering industry. The finished product has improved in quality and production "headaches" have been minimized, even eliminated by the use of demineralized water. Several units are already in use in nickel and other plating industries.

★ ★ ★

IT is up to you gentlemen to try the effect demineralized water may have to reduce and solve your problems in operations in the wire mill which are largely dependent on water, such as liquor coating, cleaning, pickling, rinsing, anodizing, plating, and possibly others.

★ ★ ★

THE use of distilled water is often impossible because of expense. No doubt, some of you are at present using systems by which you remove certain cations, such as calcium and magnesium. In certain cases it will be of advantage to remove not only the above, but all other cations present in the water, and also all the anions, such as chlorine, sulfates, etc.

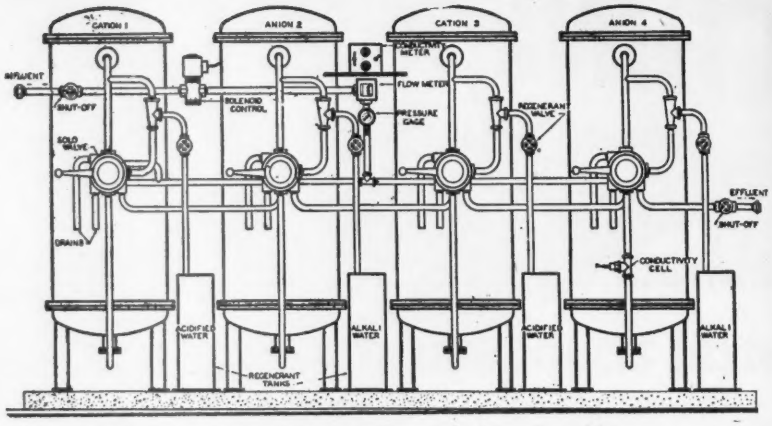


Figure 5. Schematic view of 4 bed system. Note conductivity cell at right. ★ ★ ★

★ ★ ★

WE are learning the value of control. Methods for chemical and metallurgical control have been developed. For certain purposes in your mills you even air condition. Water is a material of as much importance and because of its extensive use it should command your attention. To obtain pure water, demineralizing is most efficient and less expensive than generally realized.

References:

1. **R. Sanders, Chemistry of Surface Cleaning, Iron Age 4/12/45 p. 62-7.**
2. **Symposium on cleaning steel. Effects of Water on Cleaning prior to Coating, Iron & Steel Engr., April 1945, p. 56.**
3. **J. Ap-Roberts, Relation Between Tap Water & Plating Efficiency, Metal Fin-**

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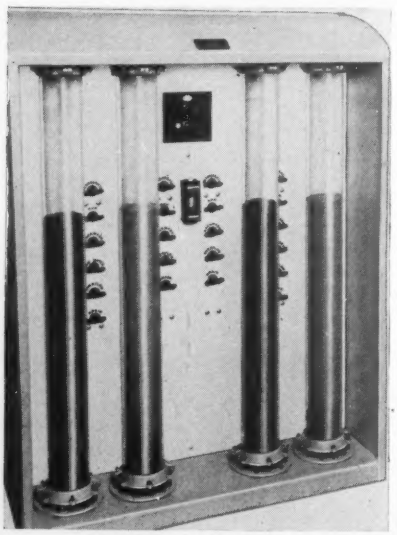


Figure 7. Laboratory four bed demineralizing unit, flow 30 gallons per hour (Capacity 5000 grains). ★ ★ ★

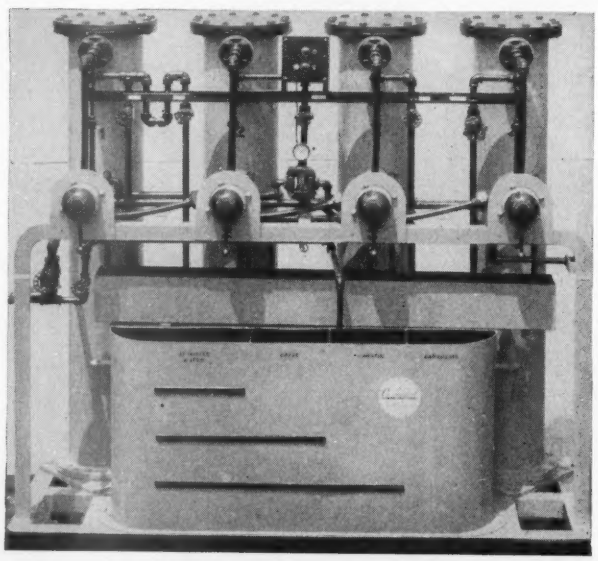
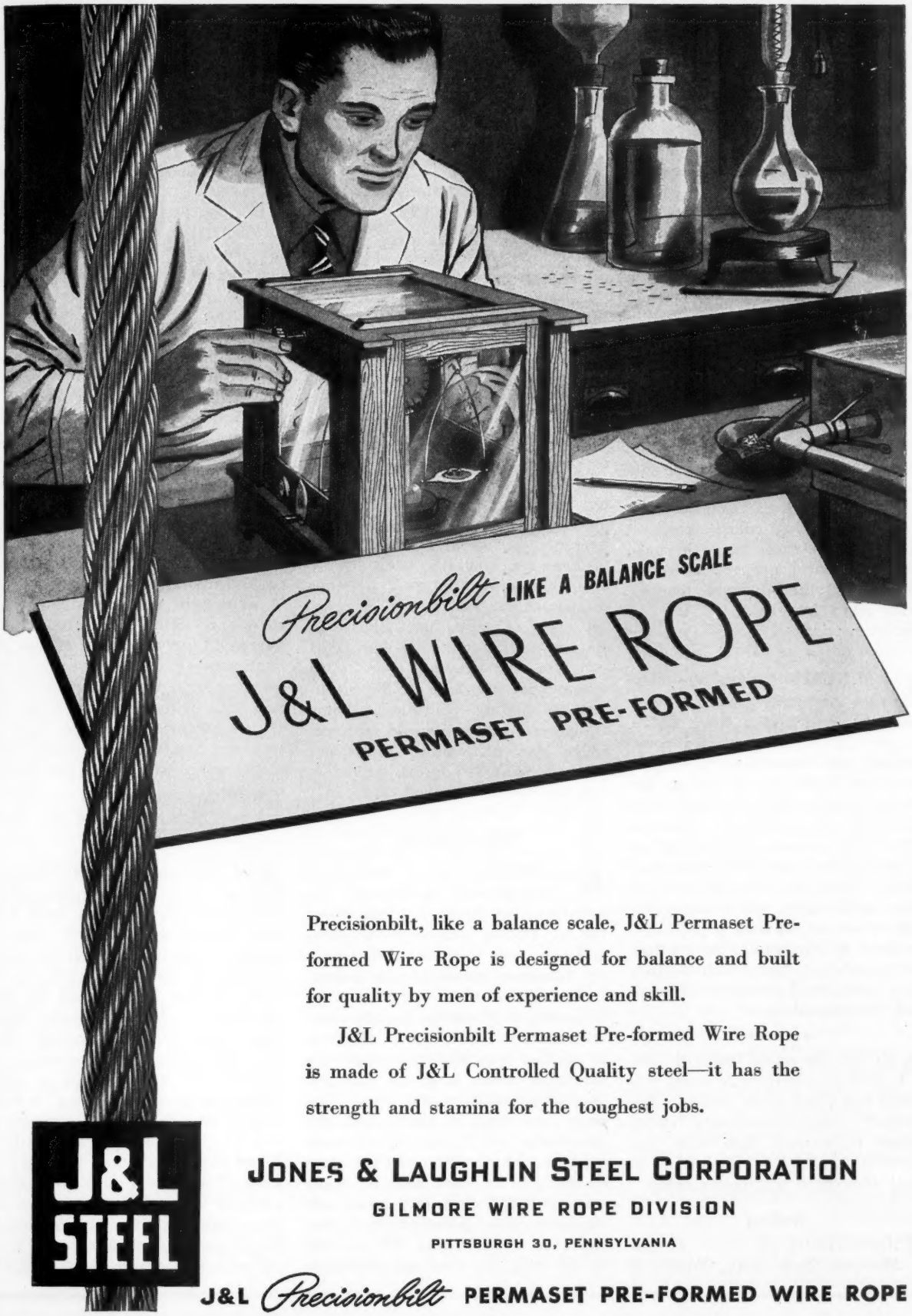


Figure 8. Industrial demineraizing unit, flow 150 gallons per hour (capacity 25,000 grains). ★ ★ ★ ★ ★ ★ ★



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ALUMINUM WIRE FABRICATION

by H. S. Spaulding
Aluminum Company of America

Production and uses of Aluminum Wire. A paper presented at the Wire Association Convention, Buffalo, N. Y., October, 1946.

INTEREST in aluminum wire products has increased greatly during the last few years. The drawing of aluminum wire, an operation which until recently was carried out in quantity by relatively few manufacturers, is now being done by many wire concerns which had before drawn only steel or copper wire.

* * *

MORE and more it is being found that aluminum wire can do many jobs better because of its low specific gravity, high electrical conductivity, pleasing color, excellent corrosion resistance, range of possible mechanical properties, workability, and other desirable factors which have increased the use of aluminum wire.

* * *

ALUMINUM and aluminum alloy wire can be produced with tensile strengths ranging from 13,000 lbs. per sq. in. for annealed commercially pure aluminum (2S-O) to more than 80,000 lbs. per sq. in. for solution heat treated and artificially aged 75S alloy (75S-T). Various alloys and tempers of alloys fill in the range between these extremes. Except for rivet, nail, and a few other applications, the greater tonnage of aluminum wire is produced in alloys which require no solution heat treatment and which acquire their mechanical properties through cold drawing alone.

* * *

AMONG the many types of standard aluminum wire being produced are rivet wire, welding and brazing wire, metallizing wire, screen cloth wire, fuse wire, and electrical conductor wire for use in steel reinforced aluminum cable.

Rolling

PRODUCTION of wire at the **Massena, New York, Works of the Aluminum Company of America** begins with the rolling of an approximately 220 pound coil of ⅜″ dia. rod on a Morgan Continuous Rod Mill. It should be remembered in comparing aluminum coil weights with those of steel and copper that steel is 2.9 times and copper 3.3 times heavier than aluminum, so that a 220 pound coil of aluminum rod of this diameter represents considerable footage (approximately 1700 ft.). Coils of ⅜″ dia. rod are also supplied to other companies for redrawing. A characteristic of aluminum which instantly appeals to a wire man is its suitability for drawing from rolled rod to final size without any cleaning or coating operations. Some alloys may be drawn in the as-rolled condition, while others are generally softened by an anneal at rod size before drawing.

Wire Drawing

ALUMINUM wire is drawn on conventional equipment, the usual practice being to break down the rod two to four passes continuously on block type machines where the lubricant for each pass is confined to the die box and then, after annealing, to draw the broken down wire on enclosed 8 to 12 die cone or tandem type machines where the lubricant covers both the dies and the wire between the dies. Fine wire sizes down to about .008″ dia. are drawn on 14 and 16 die cone type machines. Intermediate sizes finishing in an intermediate temper and in coiled form are commonly drawn on double-deck type blocks. Drawing speeds from 400 to 1600 ft. per min. for sizes approximately 3/16″ dia. and over and from 500 to 5000 ft. per min. for smaller sizes are used. No speed limitation has been found for the drawing of aluminum provided the wire temperature can be kept reasonably low.

* * *

DRAFTING follows somewhat the same pattern as for other metals. Reductions of 30 per cent per pass are used above approximately .156″ dia. and one Brown & Sharpe gauge number reduction per pass for sizes under .156″ dia., in which size range drawing is performed on machines set for one gauge number reduction per pass. In some cases, to take advantage of the workability of aluminum on machines set for Brown & Sharpe reductions and having a limited number of dies, reductions as high as 30 per cent per pass are used without encountering difficulty with the increased slip on the capstans. More recently, the tendency has been to purchase machines which are set for the heavier drafts.

Lubricants

ALL lubricants used at the present time are petroleum base oils. For most alloys in final sizes over approximately .032″ dia., a straight paraffin base oil having a viscosity of 2500-3500 S.S.U. at 100 degs. F. has been found to give excellent results. For smaller finish sizes down to approximately .008″ dia. (3S gauge) it is necessary to reduce the viscosity to a point where the familiar "looping" is eliminated. An oil having a viscosity of 100 S.S.U. at 100 degs. F. has been found most satisfactory for this purpose. Sizes under .008″ dia. down to .0025″ dia. (42 gauge), the smallest aluminum wire size drawn at the Massena plant, are drawn in an oil with a viscosity of 40-50 S.S.U.

at 100 degs. F. All these lubricants are pumped so as to supply a copious quantity of lubricant to each die and to the capstans on enclosed machines without automatic slip compensation. The lubricant is normally contained in a large volume tank equipped with some type of cooling device to maintain the lubricant temperature below approximately 160 degs. F. Best results on larger sizes where "looping" is not a problem are obtained with the lowest possible lubricant temperature. Heating of the lubricant may be necessary for the very small wire sizes.

* * *

THE previously-mentioned lubricants were chosen because they permit the drawing of all of the aluminum alloys into wire having a satisfactory surface and for their freedom from staining after an anneal or solution heat treatment. The necessity for having a versatile lubricant in a mill of Massena's type can be realized when it is considered that as many as 15 different alloys must be drawn through the same setup at rather frequent intervals. In many types of machines drawing the coarser wire sizes, it may be desirable to use a more viscous or even a solid lubricant which can be contained in the die box and which need not be pumped. It has been found that a grease of medium viscosity which will roll in the die box or neutral powdered soap will give satisfactory results. When using grease, it is necessary to pay particular attention to cleanliness to prevent staining after annealing. Powdered soap tends to give a non-uniform stain after solution heat treatment which may, however, not be objectionable for many applications.

Die Practice

DIE practice is similar to that for copper and steel. Both tungsten carbide and diamond dies are used, tungsten carbide dies being used down to approximately .0285" dia. (21 gauge) and diamond dies for smaller sizes. A plant which has no diamond die finishing equipment finds it economical to use as few diamond dies as possible. The diamond dies which must be purchased to meet close tolerances on fine wire are, in such a case, used up to the limit to which they can be recut. Any manufacturer having equipment for finishing his own diamond dies should be able to use them up to the maximum size he uses for other metals provided the proper die contour is maintained.

* * *

THERE is nothing unusual about the die contour used for drawing aluminum since only slight changes are necessary in the approach angle and length of bearing from those used for other metals. While it is difficult to give any reliable figures regarding die life, from our limited experience in drawing copper wire we would conclude that there is more wear per foot of wire drawn than when drawing aluminum. Die wear, however, is not a serious problem in drawing aluminum wire.

Heat Treating

AS mentioned previously, a large proportion of the tonnage of aluminum wire produced requires no final heat-treating operation, the desired properties being obtained by controlling the reduction following an intermediate anneal or by annealing at final size if dead soft material is required. Most alloys are annealed at 640-670 degs. F. Recrystallization is instantaneous in this range and it is therefore unnecessary to soak provided all points in a load have reached the required temperature. Gas, oil, or electric heating may be used for annealing and no atmospheric control is necessary. Forced circulation is very desirable, and if not used care must be taken to see that no point in a load heats over approximately 670 degs. F. or partial solution heat treatment will result in some alloys. Wire after annealing should be permitted to cool naturally in air.

* * *

Annealing

ANNEALING is necessary not only to control the final properties but also to remove strain hardening following a drawing operation so that further drawing may be performed. Each aluminum alloy has a maximum practical reduction in area which it may be drawn before annealing is necessary. Most alloys fall in the range of 70-95 per cent reduction in cross-sectional area. One example of the working that can be given aluminum is the drawing of ⅜" dia. commercially pure aluminum rod to .052" dia. in 10 passes on a tandem type machine at 2250 ft. per minute. This is a total reduction in area of 98 per cent.

Welding

ALUMINUM rod and wire are welded before drawing, using electric butt welders similar to those used for copper and steel wire.

Applications for Aluminum Wire

OF the numerous applications for aluminum wire, two are of special interest: Wire for electrical conductors, which is frequently used stranded over a steel wire core (aluminum cable steel reinforced — A.C.S.R.), and insect screen cloth which is made from Alclad 56S wire. The aluminum wire used for electrical conductors is of a higher purity than commercially pure 2S aluminum so that a conductivity of 61% of the International annealed copper standard is obtained in a hard drawn wire. This wire composition is designated E.C. for "electrical conductor." For equal volume, E.C. has approximately two-thirds the conductance of commercial hard drawn copper and for equal weight, about twice the conductance (or half the resistance) of copper. Electrical conductor wire in the hard drawn condition and in the sizes made into A.C.S.R. has a tensile strength varying from approxim-

(*Please turn to page* 844)

The Manufacture of Steel for Basic Rope Wire

By Ralph D. Hindson

The Steel Company of Canada Limited
Hamilton, Ontario

A discussion of the manufacture of rope wire from the open hearth to the finished rod. A paper for presentation at the Wire Association Convention in Buffalo, New York, October 21-24, 1946.

I have been given to understand that most of you are interested in rope wire and so for the next few minutes I will outline for you the various steps in the manufacture of rope wire from the Open-Hearth to the finished rod. The grade that I am choosing is the one that we make the most of, namely, plow steel which has the following analysis:

C	P	S	Mn	Si
.71/.75	0/.03	0/.04	.55/.70	.18/.25

Most of this article, however, would be equally applicable to any of the killed rope wire grades.

* * *

BEFORE I go any farther, I hope I am not making any mistake in assuming that you are all familiar with the construction and general layout of the Open-Hearth furnace and auxiliaries. If there are any questions in this regard I will do my best to answer them. We will now proceed to make a heat of rope wire to the above analysis.

* * *

A 100-ton basic open-hearth furnace has just been tapped and, after the tap hole has been plugged, and any necessary repairs made to the bottom of the hearth and side walls, the charging of the furnace commences. There can be variations in the order and type of charge but in general our practice is as follows:

* * *

LIMESTONE, which amounts to 10% of the total charge, or 20,000 lbs., is charged first. Our normal limestone charge runs about 8.5%, but on rope wire heats a larger amount is used. The purpose of this limestone is to act as a flux, that is to make the charge fluid. Without the use of a flux it would be impossible to melt the charge and remove the impurities. Lime (CaO) is a base, and like all bases, it will combine with an acid lowering the melting point of the resultant product, which is called a salt. Our common table salt is such a product, being formed by the reaction of the base sodium hydroxide with hydrochloric acid. The resultant salt formed by the reaction of lime on the acid impurities in the charge, such as silicates and phosphates, is called slag.

* * *

WE do not use a flush-off slag on our rope wire heats and therefore, no ore is charged. A flush-off slag would considerably lower the manganese content of the bath as well as build up an undesirable iron oxide content.

* * *

AFTER the limestone, about 100,000 lbs. of scrap is charged, this amount representing 50% of the metallic charge. We naturally try to charge as clean and as heavy a type of scrap as possible. If light rusty scrap is charged we run the chance of the bath being over-oxidized. This over-oxidation, which is in the form of iron oxide (FeO) has an adverse effect upon the quality of the steel and makes final complete deoxidation more difficult to attain. Also, with over-oxidation at the beginning of the melt down you run the chance of melting soft. By melting soft I mean that the percentage of carbon in the bath after it is completely molten, may not be sufficiently high to allow for proper working of the heat. Generally, the percentage of carbon at melt down should be about .40% over the carbon specified. Light scrap, particularly bundled sheets may contain fairly high percentages of alloy contaminants such as tin and copper and this is definitely undesirable. In summing up the disadvantages of light scrap one might say that its unpredictability is its worst feature.

* * *

AFTER the limestone and scrap have been added no other charge is made for about three hours. During this period the scrap has become partly molten and a thin layer of slag begins to form on the surface. This early slag is quite high in iron oxide (FeO) which is formed by the direct action or oxidation of the iron by the hot air coming up through the checkers. It is important to keep the percentage of iron oxide (FeO) in this first slag at a minimum, since this percentage may have a direct bearing on the final quality of the steel being made. As I mentioned before, heavy, clean scrap will help do this.

* * *

THE next step in the manufacture of this heat of rope wire is to add the pig iron, or as we call it "hot metal". This hot metal is added to the front of the furnace by means of a ladle and runner, the amount being equivalent to 50% of the metallic charge, or close to 100,000 lbs. This is done after the scrap has been partly fused.

AS you know the principal function of the open-hearth is to refine pig iron and turn it into steel. To do this the 6% metalloids present in the pig iron must be reduced to about 1%, the balance going into the slag. A look at the analysis of a typical cast of pig iron will show you what I mean.

C	P	S
3.4%	0.3/0.4%	.03/.04%

Mn	Si	Fe
1.4/1.8%	1.00/1.25%	94.0%

* * *

AS you can see the metalloids carbon, phosphorus and silicon are too high to conform to an average steel analysis and, therefore, must be at least partially removed. This is accomplished in the Open-Hearth by oxidation, the carbon being the controlling factor. Unfortunately we cannot remove one without the other, therefore, in the case of manganese for example, we have to remove nearly all of it in order to get our carbon to the desired point, and then we have to turn around and add more manganese to bring the heat up to chemical specification. By the time the carbon has been oxidized to the desired point very little of the phosphorus, manganese of silicon remain.

* * *

AFTER the hot metal is added the scrap continues to melt and slag forms at the surface. The formation of this slag represents the first stage in the purification of the charge to produce steel. It so happens that the metalloids in the pig iron oxidize preferentially, that is, the silicon, manganese and phosphorus are removed in the order given, until a stage is reached in which all three plus the carbon are being removed. These impurities are oxidized principally by the 16% oxygen present in the air to form their respective oxides which, with the exception of manganese, are acids. The insoluble acid oxides of silicon and phosphorus rise to the top where they are joined or neutralized by iron oxide which is a base, the product of this union being our first slag. Since manganese oxide (MnO) is a base, it acts a little differently. It may combine with silicon dioxide ($S_1 0_2$) to form a single and larger slag particle, or it may rise and remain dissolved in the slag. A certain amount of this manganese oxide may also be reduced to metallic manganese by some of the metalloids remaining in the bath. It should be mentioned here that the chemical union of oxygen with silicon, manganese and phosphorus, produces heat, the reaction being known as exothermic. This added source of heat will naturally assist to raise the temperature and melt the scrap.

* * *

ABOUT three quarters of an hour after the hot metal is added the scrap is usually completely melted and the lime boil begins. The limestone ($CaCo_3$) laying on the bottom of the furnace, calcines at about 2550°F, and when this temperature is reached, the limestone breaks up into calcium oxide (CaO) and carbon dioxide ($C0_2$). The carbon dioxide being a gas, passes up through the bath causing a considerable boiling action, that is called the lime boil. This boiling action thoroughly mixes the bath bringing the lime in close contact with the impurities as it rises to the surface to form the main constituent of the slag. This calcium oxide, or lime as it is commonly called, is a strong base and it replaces the iron oxide (FeO) in the first slag, producing a stable, basic slag. As long as there is an excess of lime present the acid impurities in the slag cannot revert back into the steel bath. In the case of phosphorus, however, a certain amount of iron oxide must also be present in the slag to prevent reversion. Using silicon as an example, what actually happens is this: The silicon is first oxidized to silicon dioxide ($S_1 0_2$) which in turn, is joined by iron oxide (FeO) to produce a slag particle. This slag, however, is not stable therefore, lime (CaO) is used to replace the iron oxide and to produce a stable slag which is actually a salt formed by the union of the lime with the acid impurities. As I mentioned before the purpose of a flux is to make fluid and without the use of lime to unite with the acid impurities such as $S_1 0_2$ and $P_2 05$ to form a fusible slag we would not be able to melt the charge. Lime is both a solvent and a sponge in that it both dissolves the impurities and holds them in the slag.

* * *

IN about two hours after the hot metal is added, the lime boil subsides and what we call the working period begins. This is probably the most important period in the manufacture of our heat of rope wire, for during this period the melter must so shape up his slag that the net result will be a good heat of rope wire. It should be clearly understood that the slag is the intermediary between the melter and the steel bath. The only way that he can adjust the chemical composition of the bath is to first adjust the slag. The slag floats on top of the steel and exercises a "closed shop" over all its actions and reactions.

* * *

TOWARDS the beginning of the working period a carbon check is taken and this point represents the melt down. Carbon checks are taken on a carbometer machine which by first magnetizing and then de-magnetizing the sample and comparing the extent of demagnetizing with a table, gives the amount of carbon present in the sample. You are all familiar with the effect of carbon on the magnetic properties of Steel. Such a check takes only a very few minutes and these checks are run at regular intervals throughout the working of the heat. If the first carbon check is too high, that is, more than .40% over the desired specification, about 10,000 lbs. of low carbon mill crops may be added as a diluent. If, however, the carbon is too low to allow for proper working of the heat extra iron may have to be added. In the case of rope wire, however, we rarely have to do either since our charge is so standardized that the heat usually melts between 1.10 and 1.20% carbon. The control of iron oxide in the slag and hence in the bath, is now the chief concern of the melter.

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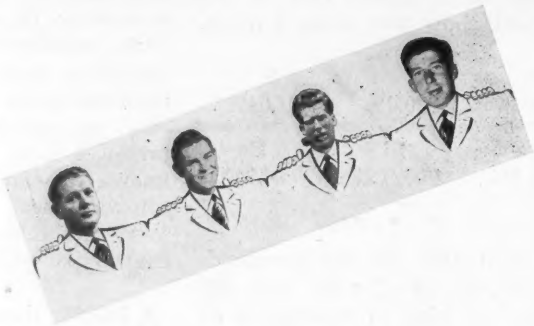

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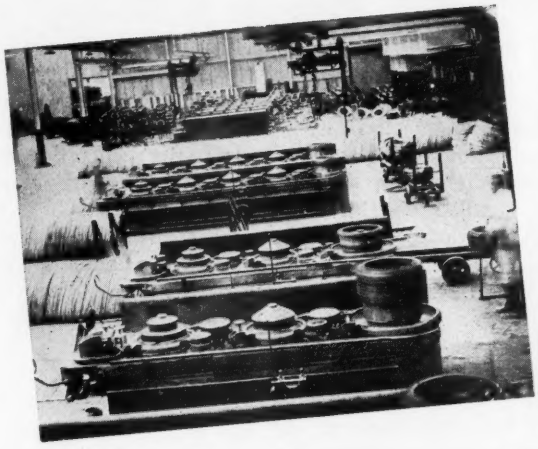

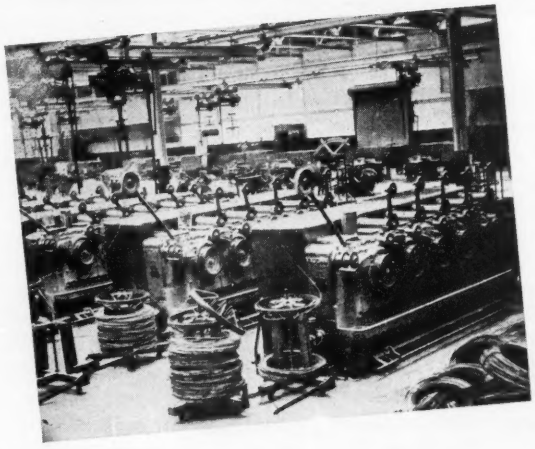

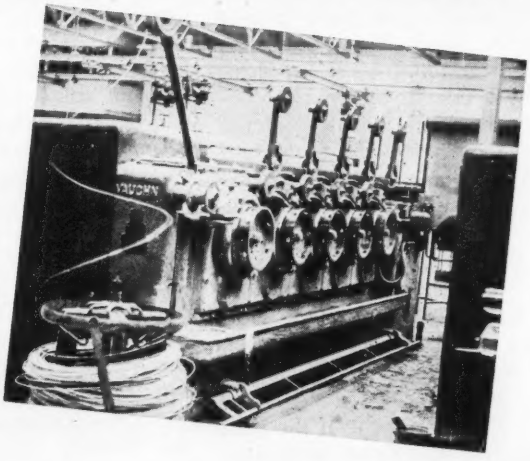

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You have all heard of slag control at one time or another, well, this is it.

* * *

DURING the working period the carbon must be dropped from about 1.15% to close to the specified carbon, which in this case is .71/.75%. This is done by the action of the iron oxide in the slag on the carbon in the bath. Without going into too much detail the oxygen in the furnace atmosphere builds up iron oxide (FeO) in the slag, which in turn migrates to the bath where it oxidizes the carbon, forming carbon monoxide gas (Co). The amount of iron oxide present in the slag must be carefully controlled and this is done by varying the viscosity and basicity of the slag. A viscous, basic slag is an indication of a high iron oxide content. Since this is undesirable on such a heat as this, the melter keeps his slag as fluid as possible by the addition of fluorspar and in some cases, sand. The lime silica ratio is maintained at about 2.2:I. Since there is a direct relation between the iron oxide content of the slag and the iron oxide content of the bath and since a low iron oxide gives a cleaner and sounder steel, you can understand the importance of slag control.

* * *

YOU can think of slag as a poultice which draws the infectious impurities such as carbon, silicon, phosphorus and small amounts of sulphur, out of the steel bath, the drawing agent being iron oxide. Once these impurities are drawn into the slag they are held there by the lime. Carbon of course passes out into the furnace atmosphere in the form of carbon monoxide and carbon dioxide.

* * *

WHEN the carbon has been worked down to a point slightly below the specified range, the heat is ready for its final treatment before it is tapped into the ladle. The reason for going down below the specified carbon is to allow for the carbon present in the ferro alloys which must be added to bring the heat up to chemical specifications. A snap has already been taken on the residual alloys including copper, tin, chrome, nickel and molybdenum and if any of these are considered too high the heat is diverted to another grade. The final stage in refining the steel now begins.

* * *

UP until now we have been refining the steel by oxidizing the impurities out of the charge. After these impurities have been satisfactorily removed, however, we must do something to put a stop to this oxidation and also get rid of any iron oxide still present in the steel bath. This is called deoxidation and it must be done in the manufacture of any heat of killed steel. In order to accomplish this deoxidation the melter simply reverses the procedure a little bit and puts back into the bath one or two of the elements previously removed by oxidation. In the manufacture of steel for rope wire we use a 79% ferro-manganese as a deoxidizer which is added to the furnace. This is different from our usual practice on killed steels. The amount added depends upon the percentage of manganese left in the bath after the oxidation cycle has been completed (usually around .25 to .30%) and on the percentage loss which the melter determines by experience and also by the iron oxide content of the slag. This loss normally figures out to about 25%. Since manganese has a stronger affinity for oxygen than does iron, insoluble manganese oxide replaces the soluble iron oxide from the bath, thus removing our oxidizing agent. This manganese oxide rises to the top of the bath into the slag. What manganese is not used as a deoxidizer remains in the steel to bring up the percentage of manganese to the required chemical specification. If any iron oxide were allowed to remain in the bath it would continue to react with the carbon producing carbon monoxide gas which would result in a porous and seamy product unsuitable for rope wire.

* * *

ABOUT eight minutes after the addition of the ferromanganese, 100 lbs. of aluminum, which has a very strong affinity for oxygen, is added to ensure complete deoxidation or in other words to ensure the complete removal of all the iron oxide present in the bath. This then is the deoxidation practice for a rope wire heat, the net result being a clean, coarse grained heat of killed steel.

* * *

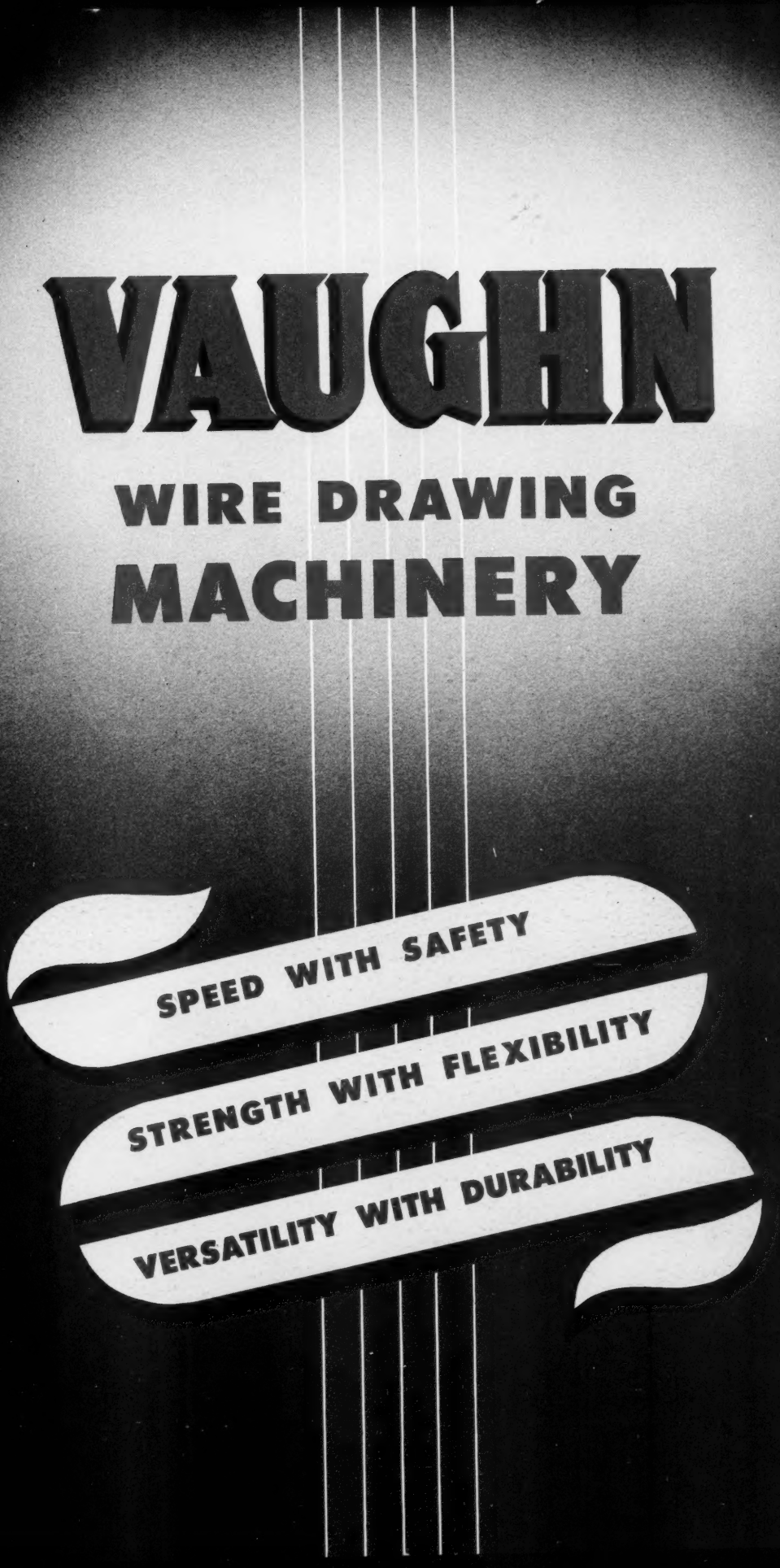
THE tap hole is now cleaned out and the heat is tapped into the ladle where further additions are made. Ferro Silicon (50%) is added to meet the silicon specification and 3 lbs. per ton of calcium manganese silicon which acts as a further cleaning and degasifying agent, is also added. The total time of the heat from start of charge to finish tap would be about 9 to 10 hours.

* * *

BEFORE going on with the pouring of the heat a word should be said about the products of deoxidation which sometimes cause you people trouble in the form of non-metallic inclusions. These inclusions are the insoluble oxides formed when a deoxidizer such as aluminum, manganese or silicon is added to the bath. Most of these deoxidation products, especially the larger particles, pass into the slag as explained above but some of the smaller particles do remain in the steel and give you your non-metallic inclusions. Ordinarily, these cause little or no trouble unless they are present either in large quantities or in large particles, in which case trouble with drawing, etc., may be experienced. By doing most of our deoxidizing in the furnace, these inclusions have a much better chance to rise into the slag, than they would in the much deeper ladle.

* * *

AFTER the heat is tapped it is taken over to the pouring deck where it is held until the temperature drops to about 2760°F. It is then poured through one 1-3/4 inch stopper into 22 x24 inch big-end-up moulds with metal hot-tops, the average ingot weight being 8400 lbs. The purpose of the big-end-up mould and the hot-top is, as you know, to control solidification of the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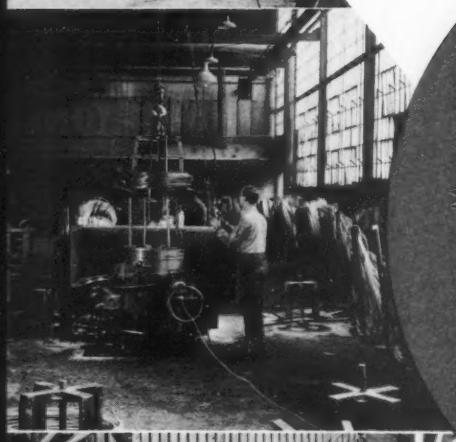

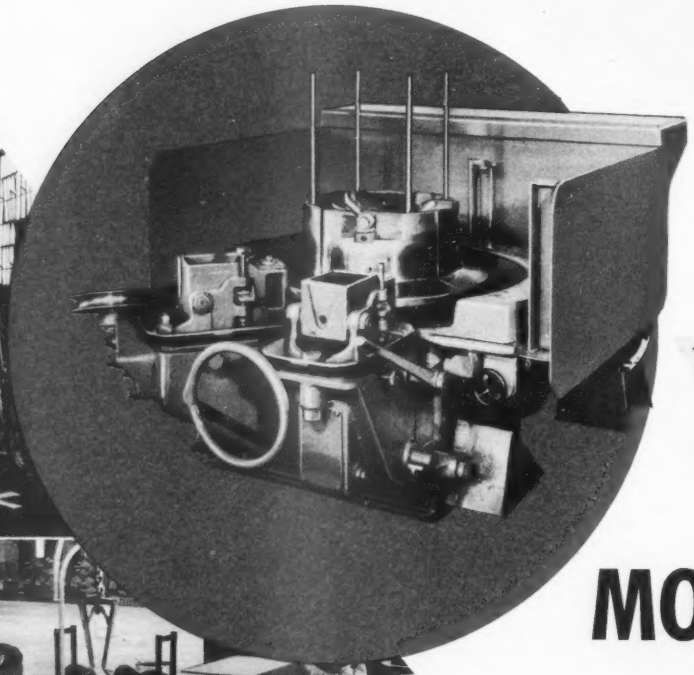

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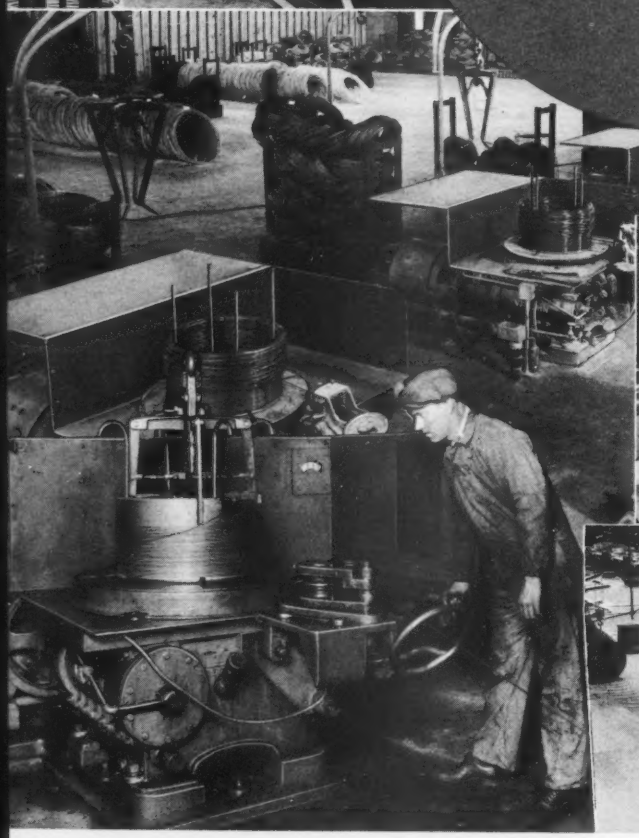

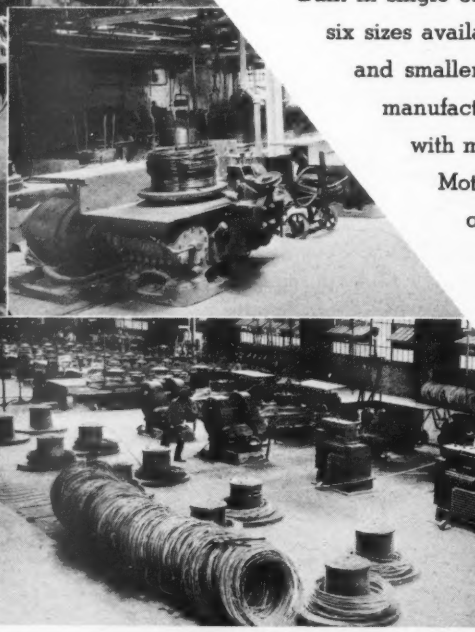

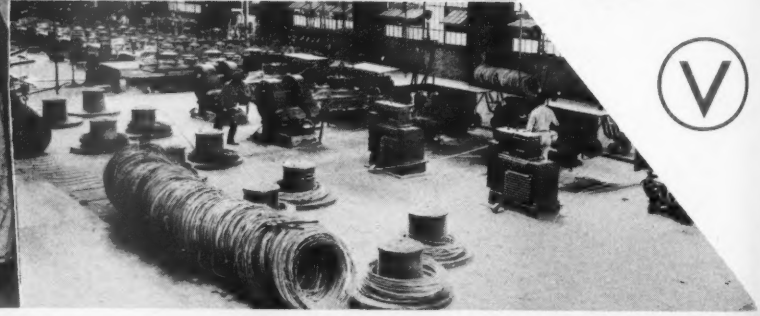

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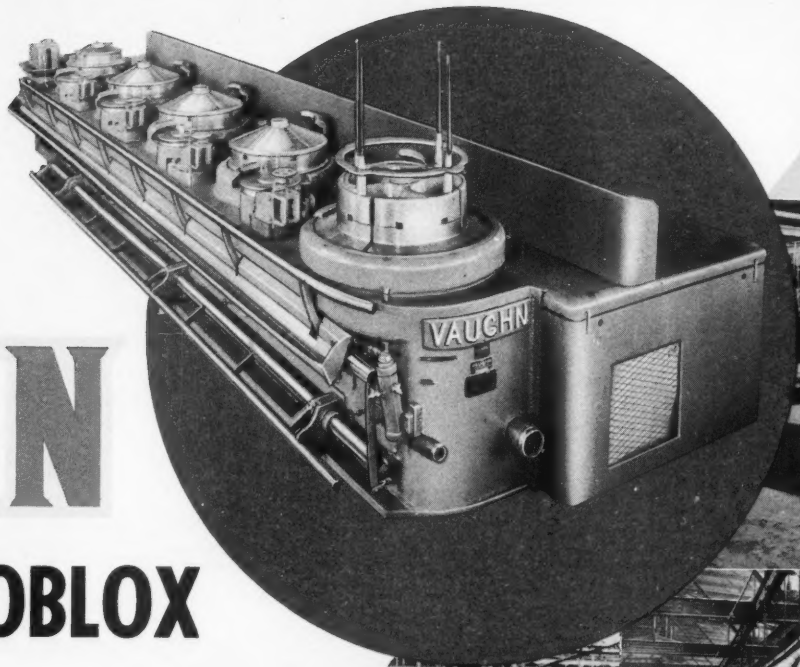

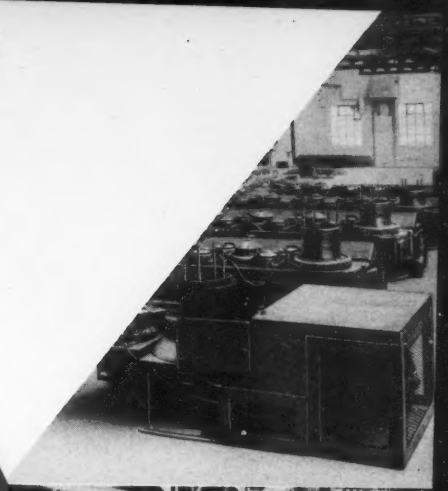

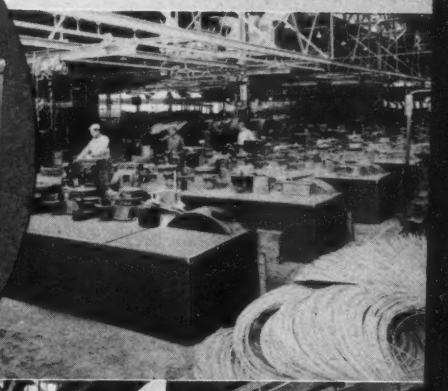

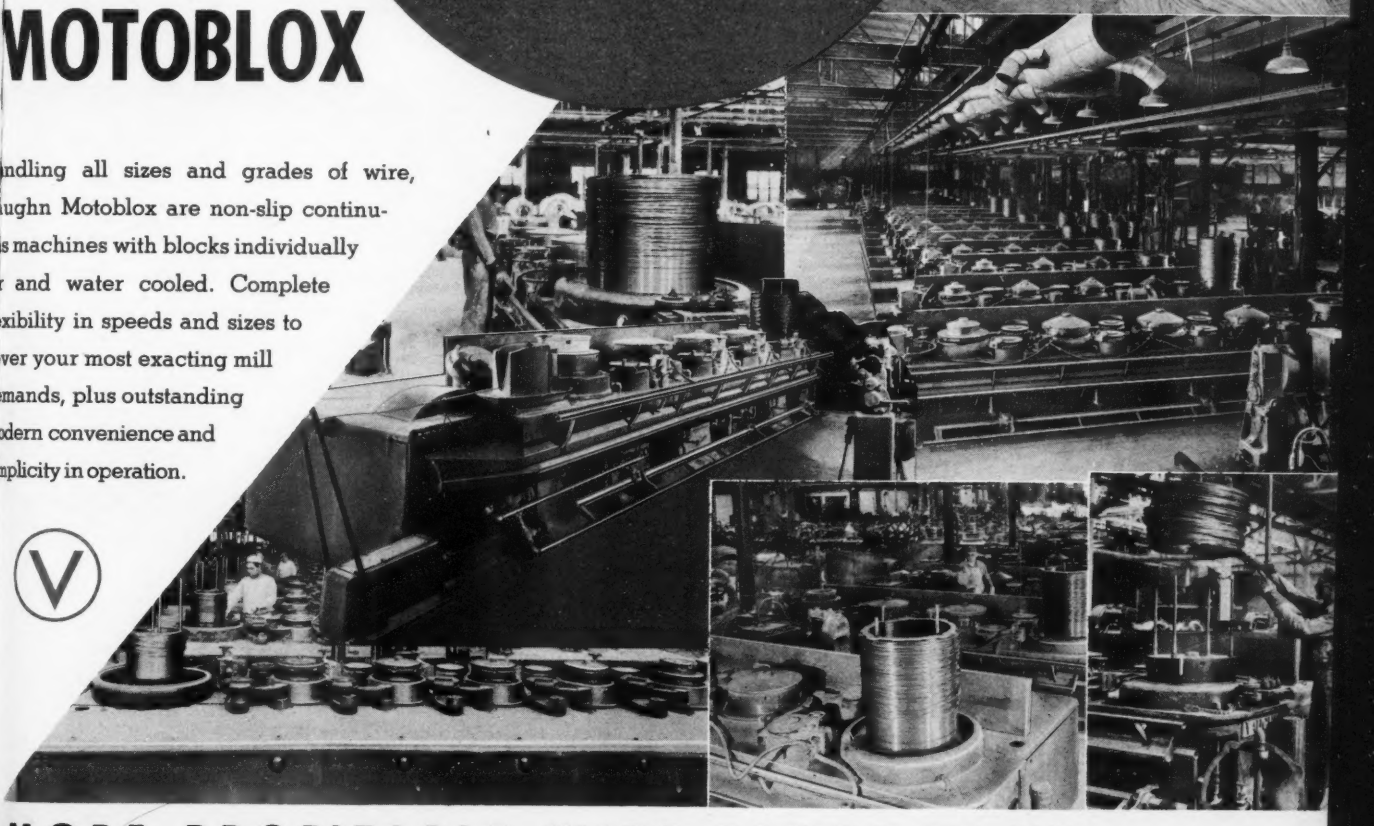

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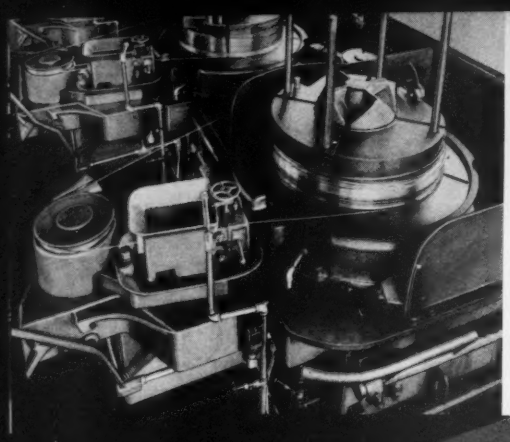

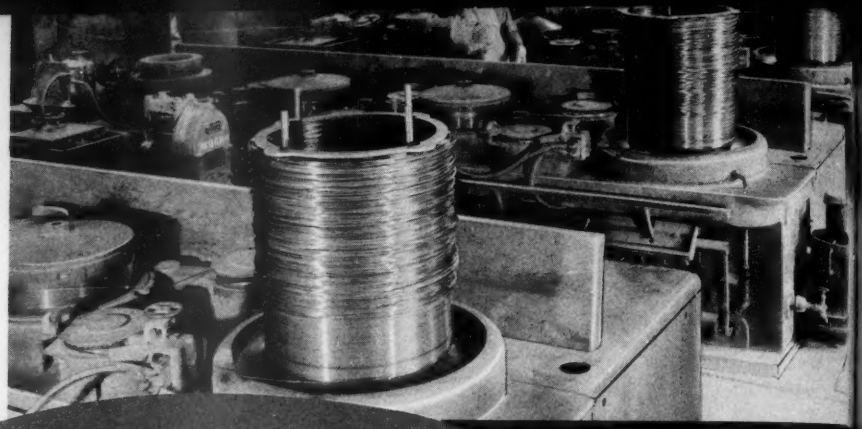

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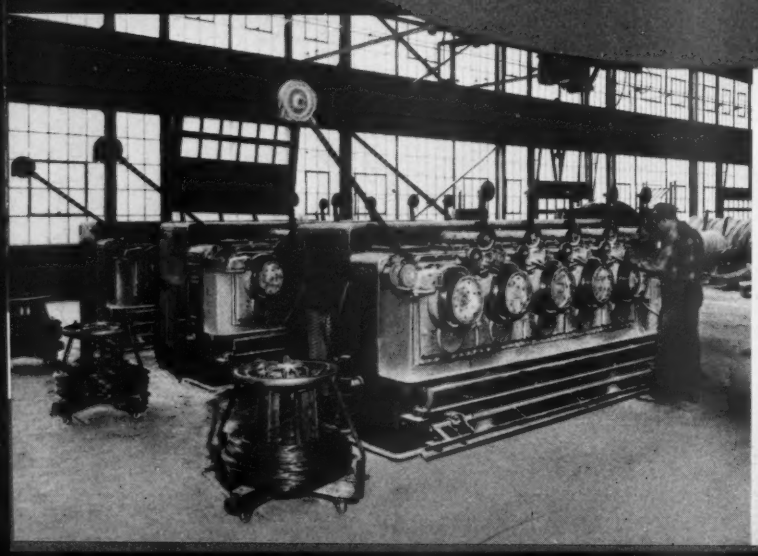

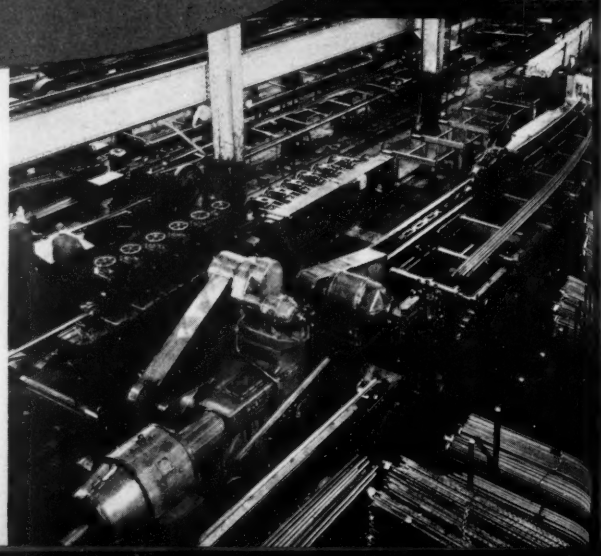

ingot so that the central portion will solidify from the bottom up, producing a sound ingot free of piping. The shrinkage cavity is entirely taken up in the hot-top. Since the central portion, especially towards the top of the ingot, is the last part to solidify the insoluble inclusions, plus carbides or any other foreign matter that may be present tend to segregate here. You have no doubt seen this condition in some of your rod or wire samples. Our mill croppage, however, is such that any injurious segregation is removed.

* * *

CARE should also be taken to see that the moulds are properly tarred and that the pouring practice is clean so that slivers and seams will be kept to a minimum. A little care here can save a lot of time and expense in the Chipping Department.

* * *

AFTER the heat is poured and allowed to stand until it is completely solidified, it is taken to the mould shop where the hot tops are removed. The heat is then taken to the stripper building where the ingots are loosened and from here it goes to the soaking pits for re-heating preparatory to rolling. The time interval from finish pour to finish charge into the soaking pits should be as short as possible and the pit temperature at charge should be such that severe differentials between the steel and pit do not occur. Our soaking pits are the bottom-fired recuperative type, built by the Amsler Morton Company. When the steel is fully soaked, or in other words, when it has reached a uniform temperature from centre to outside, it is ready for rolling. The ingots are then drawn and rolled through two blooming mills located in series. The first breakdown mill is a 44-inch mill, which rolls the 22 x 24 inch ingot down to a 10" x 10" bloom. After the hot-top is cropped this bloom is then reduced in the second 34-inch mill to a 5½ inch square. From there the 5½ inch square bloom passes into a continuous 18-inch billet mill where it is reduced in eight stands of alternate diamond and square passes into a 1-23/32 inch billet, 30 feet long, and weighing 300 pounds. The top two billets are diverted and the next two are etch tested to ensure only sound steel free of piping and injurious segregation being used for rope wire. After the steel has been thoroughly inspected and chipped if necessary, it is ready for charging into the rod mill. I might say here that this grade of rope wire usually has a very good surface requiring little conditioning.

* * *

WE now come to the rod mill which is a little closer home for you people here today. Unfortunately, from the standpoint of making this article more interesting, our rod mill is not very modern, nor is it very different from many other rod mills scattered throughout this great country of yours. It is a two-strand Morgan Continuous Rod Mill built about the time I was born. In spite of its age, however, this rod mill is still doing a very satisfactory job, and in view of this, the necessity of replacing it has not yet arisen. In brief, our setup is as follows:

* * *

WE use a producer gas-fired furnace with sixteen ports located at one end. The furnace has six skid rails and a capacity of 180 billets, or 27 tons. The heating temperature is kept as close and as uniform as possible to between 1900 and 2100°F, since we are keenly aware of the effect of varying temperature on the finished section. In the case of rope wire we aim for the high side of this range, whereas for some of the softer steels, we aim for the low side. We have sixteen stands in all, the reduction being accomplished by a series of oval and square passes. The ovals enter the square vertically and the squares enter the oval on the flat, this being done by means of twist guides. The first six stands are roughing stands which have a 12-inch pitch diameter. Next we have four intermediate stands with a 9½ inch pitch diameter. These first ten stands are driven as a unit by one 1600 H.P. motor. Stands 11 and 12 have a 10-inch pitch diameter and stands 13 to 16, which are called the finishing stands, have a 10½ inch pitch diameter. These last six stands are driven by a second 1600 H.P. motor. We change complete stands instead of rolls and therefore, save considerable time in setting up the mill.

* * *

IN case there is someone here who is wondering what I mean by a "stand" I had better explain myself. A stand is a housing complete with a set of two identical rolls which in this case, have alternate oval and square passes. These passes are sually the same size across the width of the roll and when one pass is worn down to such an extent that a proper section cannot be obtained, the guides are moved over and another pass used.

* * *

OUR size range varies from No. 5 rod to .531 inch (17/32) and although the mill is equipped with a hot bed we are currently coiling all material rolled on this mill. All of the sixteen stands are used for rolling No. 5 Rod, No. 14 and No. 16 stands being rounds. On the smaller sizes of heavy rod we finish in No. 14 stand, whereas on the still heavier sizes only stands 1 to 8 and 12 to 13 are used. This can be easily understood when you consider that when the same size billet is used in all cases there will naturally be less reduction and therefore, fewer stands as the finished size is increased.

* * *

WITH a Rod Mill motor of 550 R.P.M. we are able to roll No. 5 Rod at the rate of 3789 feet per minute per strand of 7578 feet per minute for both strands, giving us a production of about 24 tons per hour.

* * *

WE have a flying shear at the end of the first six stands where the front ends, which are usually spread open, are cut off. This gives us a smooth end at the finish and in some cases prevents cobbles. The size of the rod at this point is about ½ inch square when rolling No. 5 rod. There is a loop between the 6th and 7th stand and

also a repeater loop before and after stands 11 and 12, making our setup a little different to the conventional straight line Morgan Mill. These loops eliminate part of the pull in the mill, giving us a better section on the finished rod.

* * *

FROM the finishing pass the two strands can be automatically led into any two of a battery of four Morgan reels which wind the rod into coils. These coils are then put onto a flat conveyor which runs underground for 160 feet from which point the coils are picked up by a hook conveyor. The coils are trimmed, tied and properly identified as they are being carried along on this conveyor, which is 840 feet long. At the end of the conveyor each coil is picked off by means of an air hoist and put onto a scale. This scale has five arms, each arm being capable of holding ten coils. Because of these arms this scale is called a "merry-go-round". After being weighed the coils are picked off by a crane and either loaded into cars or piled on the floor preparatory to patenting. We patent only part of the rope wire produced, the balance being done at the customer's plant. So much then for our setup.

* * *

A word should now be said about some of the problems which confront the rod mill roller and which, if not properly handled, can cause you people as wire drawers and users, some concern. First of all it must be understood that a rod mill is a continuous mill where rolling is all done in one direction. This being so, variables in section can easily occur. Let us first consider the difficulties the rod mill roller has in giving you people a satisfactory section, for it cannot be denied that our individual problems are actually our mutual problems.

* * *

AS you know, the rod mill consists of several stands of rolls located very closely together. Since one billet may stretch from the first to the last of these stands, the first part of the billet being already reduced to say No. 5 rod, whereas the last part is still the original size of 1-23/32, each mill must travel at such a rate that a constant volume of stock is being delivered from each and every stand of rolls. There must be no interruption or irregularities in the flow of the material through these stands. If the flow of steel is too great, cobbles will result, if too little, the bar will pull and a smaller section will be the result. Some of the causes of an interrupted flow of the rod as it passes through the various stands are as follows:

* * *

FIRST, there is what we know as slipping. Certain grades such as chrome, nickel, steel wool, high manganese and high sulphur tend to slip in the mill causing an off-section rod. Grades such as these are usually run a little colder to reduce this tendency to slip. Rope wire, however, because of its low manganese gives the roller very little trouble. A lack of uniform temperature throughout the billet can cause considerable variation in the section of the finished rod. This is due to the fact that cold spots put more pressure on the mill, spreading the bearings, the net result being a thicker section. In severe cases the spring in the mill caused by cold billets will be sufficient to stall it. This, incidentally, is an ideal time to cut samples showing the various stages in the reduction of the billet to the finished rod. Hot spots, on the other hand, cause the bar to pull since these slip in the mill and don't give sufficient stock to fill up the succeeding passes. In severe cases the bar may pull apart, whereas, in milder cases an overall reduction in the size of the bar may occur. Once a pull takes place the stock cannot overcome it and fill up the following passes. It is for this reason that the roller always keeps his mill crowded. By this I mean that each roll is pushing the one ahead of it and thereby keeping the passes plugged at all times.

* * *

IN regards to the surface of the rod very little difficulty is experienced with rope wire because of its characteristically good surface. If, however, there happens to be some small slivers on a billet, they sometimes drop off and stick to the guides causing a scratch on the finished rod. In the case of overfills these may be caused by cold steel, since cold steel spreads more than hot steel, or they may be caused by too much stock being pushed into the pass. The top and bottom roll are usually kept about 1/8 to 3/32 inch apart to prevent overfills. If these two rolls are too close together, the stock will be forced between what slight parting does exist and an overfill will result. The reason that rods are slightly out of round, is due to the necessity of maintaining a slight parting between the top and bottom roll.

* * *

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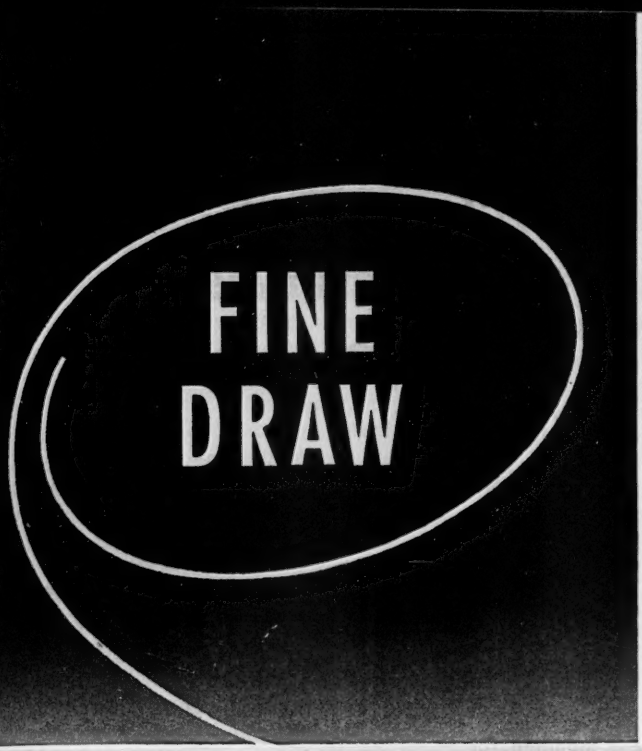

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The Application of the Cyclograph to Non-Destructive Inspection of Materials; In Particular, Wire Rope

by Dr. O. W. Ellis, Director

Department of Engineering and Metallurgy
Ontario Research Foundation
Ontario, Canada

This brief paper may be looked upon as an interim report on work now being carried out at the Ontario Research Foundation by the incumbent of the DuMont Fellowship, Mr. P. E. Cavanagh, to whom the author is indebted for assistance in the preparation of this paper. There is a wide field here open for extensive work, a field which if properly developed should yield a good harvest.

THE **DuMont Cyclograph** is an instrument which was designed primarily to facilitate the non-destructive inspection of materials. It utilizes the principle that the core loss of a tuned pickup coil surrounding a piece of metal is a function of the physical state of the metal. A change in the state of the metal will cause a change in the power loss of the tuned circuit of which the coil is a part. The change in the power loss is made visible on the cathode-ray indicator screens with which the Cyclograph is equipped.

* * *

THE instrument is of special interest due to the fact that pick-up coils of various frequencies can be employed. In theory there is no limit to the number of frequencies that can be employed, in practice they are generally limited to three. Core loss is a function not only of the physical state of the metal forming the core of the coil, but also of the frequency of the oscillations in the coil. It is of special importance to note that the depth of flux penetration into the core varies with the frequency of the current in the coil. The higher this frequency the less is the depth of flux penetration. Hence, if two pieces of homogeneous metal in the same physical state were fashioned, in one case into a solid cylinder and in the other into a thin-walled tube of the same outside diameter, it would be impossible to distinguish between them were current of sufficiently high frequency passed through the pickup coil into which they were successively placed—the patterns on the indicator screens of the instrument would be the same in both tests — see figure 1. A point would be reached, however, when, as the frequency of the current in the coil was lowered, the depth of flux penetration would exceed the wall thickness of the tube. As soon as this point was reached the patterns for the two pieces on the indicator screen of the Cyclograph would differ in form (see figure 2). If the two pieces were long enough, so that, when subjected to tension, the stresses were uniformly distributed over their cross-sectional areas, the cylinder could readily be distinguished from the tube, even were it impossible to do so otherwise, by applying the same load to both pieces. The unit stress in the tube would, under these conditions, be higher than that in the cylinder—the **physical** state of the tube would differ from that of the cylinder and the two pieces would, therefore, exhibit dissimilar patterns on the Cyclograph screen. The difference between the two pieces could be

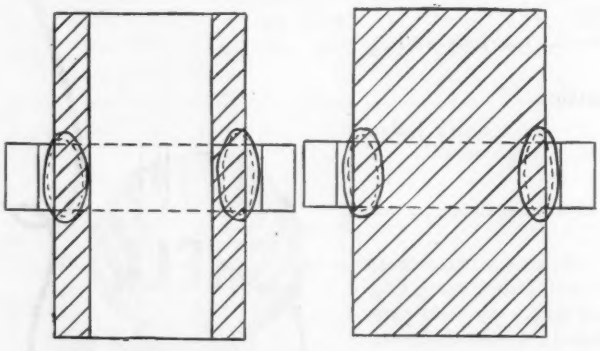

Fig. 1.

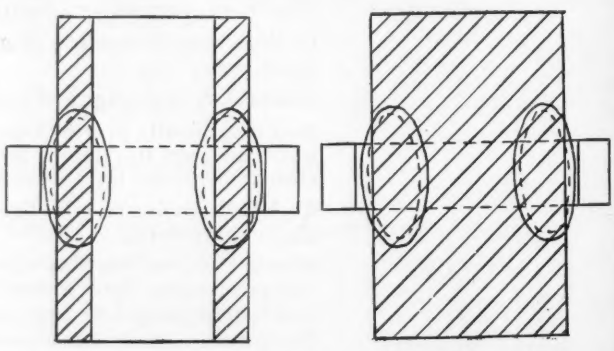

Fig. 2.

more readily distinguished by passing high frequency rather than low frequency current through the pick-up coil.

* * *

EVEN though the physical state of the two pieces when stressed were the same, as would result from stressing (not loading) them equally, the two could again be distinguished one from the other by altering the frequency of the current in the coil and thus changing the depth of flux penetration.

* * *

IT is of interest to speculate on the effect of dimensional changes in the core on the power loss in the coil surrounding the core. Imagine a long tube of homogeneous metal subjected to a constant load which, at all times and under all conditions, results in a uniformly distributed stress over the tube section. Let us suppose that the outer or/and inner diameters of the tube are subject to uniform change, such, for example, as might result from external or/and internal corrosion, erosion or other chemical or mechanical causes. As a result of any such causes the outer diameter would become less or/and the inner diameter would become greater. Concurrently the stress in the tube would increase and the physical state of the metal change. It can be shown that a relatively large increase in internal diameter due to such causes as those referred to above would be required to raise the stress in the tube to the point resulting from a small decrease in external diameter due to the same or similar causes. For example, a change in the thickness of a 4″ O.D. 2″ I.D. tube of 0.250″ caused by **external** corrosion would raise the stress in the tube by the same amount as a change in the thickness of the tube due to **internal** corrosion of as much as 0.392″. For **very small** reductions in **external** diameter the equivalent increase in **internal** diameter required to cause the same stress in the tube is proportional to the ratio of the outside to the inside diameter of the tube. From the above it will be clear that for equal reductions in wall thickness **internal** corrosion will cause a lower increase of stress in the tube than **external** corrosion.

* * *

THE above leads to the view that, were the inner diameter of the tube alone being affected by corrosion, erosion, etc., there would be no particular advantage in using a higher rather than a lower frequency coil for the purpose of detecting the change in state of the metal in the tube due to increase of stress. Given that the flux sufficiently penetrated the outer surface of the tube the change of state would be at once detected. As the stress in the tube increased due to internal corrosion so the pattern on the Cyclograph screen would change.

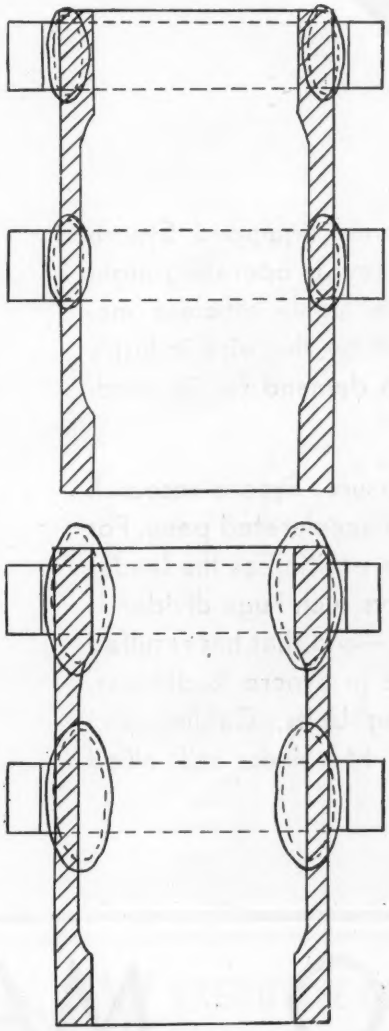

Fig. 3.

ON the other hand, if external corrosion alone were reducing the cross-sectioned area of the tube, the use of high frequency current might lead to erroneous conclusions, due to the fact that the depth of flux penetration would be changing due to the removal of metal from the outside of the tube. The power loss would be affected both by this cause and the change of stress in the tube. (It would not be difficult to choose a coil so as to enable both these functions to be distinguished one from the other.) But it would be better and easier to take advantage of the multiplicity of frequencies that are available in the Cyclograph and follow the changes in the screen pattern caused by changes in stress, first with a coil of, one frequency, then with a coil of another frequency, and so on. If all the coils were calibrated a very complete picture of what was happening to the tube could be obtained.

* * *

NOW let us consider the case of a long tube of homogeneous metal which, for some peculiar reason, is, over a relatively small portion only of its length, subjected to internal corrosion. The tube is loaded longitudinally, but, because its cross-sectional area is reduced over a small portion of its length, the stress in the metal in this vicinity will be greater than that elsewhere. If a suitable pickup coil is passed up and down the tube the fact that the physical state of the metal is different where the tube has been corroded will be at once detected by observation of the pattern on the Cyclograph screen. The corroded section of the tube will be picked out with exactitude. Actually it would not be necessary to place the tube under stress to pick out the corroded section, because, by using suitable coils the fact that the thickness of wall varied over the length of the tube could be demonstrated with ease — see figure 3.

* * *

NOW the tube under stress happens to be in some small degree analogous to a wire rope in service. However, the application

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of the Cyclograph to the testing of wire rope in service is fraught with far greater difficulties than are suggested above. In the first place the loads imposed on a rope in service are complicated, to say the least. It is true that ropes in service are almost invariably in tension, but most are subjected also to bending, and many are placed in torsion as well. The author would suggest, however, that, in many situations, the loads (not stresses) imposed on a given length of rope do not change appreciably in kind while in normal service. Hence, if a suitable pickup coil is placed round a rope in service, e.g. round an elevator rope, the pattern shown on the Cyclograph screen is likely to remain much the same for every short length of the rope unless that short length is subject to a change of state. The pattern may vary as the rope passes through the coil, because in this special respect the rope differs from the tube we have been discussing — relatively speaking, **it is far from homogeneous, especially in terms of magnetic properties.** Experience has shown, however, that the variations in pattern due, for example, to relative movement of wires and the consequent changes in stress distribution within the rope, with a new rope are not appreciable, certainly not so much so as to eliminate the Cyclograph as a possible tool of continuous nondestructive inspection. They do not interfere with the usefulness of the tool, since they are major permanent changes in pattern that are looked for.

* * *

WHAT, then, would constitute a change in state in a wire rope? The answer to this question would seem to be "Anything that causes a permanent increase of stress at any point in the rope." Such a permanent increase of stress at any point could result from abrasion, from bruising, from kinking, from rupture of one or more wires, from external or — still more insidious — internal corrosion at any point. The normal wear and tear of a rope will result in a continuous change in the whole Cyclograph recording pattern. On the other hand, local defects will cause local concentrations of stress which will show up as definite perturbation in the pattern is dewire passes through the pickup coil. The position of the local defect, even though invisible to the unaided eye, and, frequently, the aided eye, can be traced by moving the rope through the coil until the perturbation in the pattern is detected. The possible defective portion of the rope will be found within the coil. Careful examination of the rope may result in the decision to continue its use in service. But warning has been given that, as it were, a weak link has been found in the chain, and, therefore, that the chain bears watching.

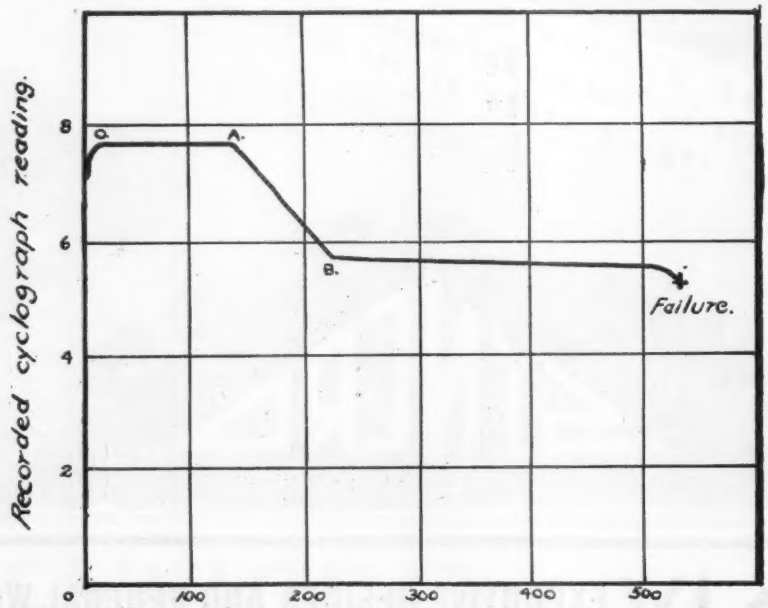

Figure 4.—Thousands of Cycles.
Representative cyclograph recording during Avery rotating bean endurance test. SAE 1025, C. R. Steel, Load, 4500. Cyclograph Reading decreases as core losses increase.

* * *

* * *

A few words here on the subject of flux penetration will not be amiss. In the case of homogeneous metal, such as that forming the cylinders and tubes which have already been the subject of discussion, the relationship between flux penetration and core loss is relatively simple. This relationship can be expressed by the formula—

$$P = \frac{140s\sqrt{\rho}}{\sqrt{\mu}} \times \frac{1}{\sqrt{f}} \text{ inches}$$

ρ Greek "rho".
μ Greek "mu".
Where
ρ = specific resistance in ohms/cm^3.
μ = permeability at low field strength.
f = test frequency.

* * *

HOWEVER, when one is dealing with magnetically heterogeneous objects, such as wire ropes, the relationship between flux penetration and core loss is far from simple. One can, in fact, only guess at the relationship — for the same core loss, the load on the rope being constant, the flux penetration is approximately double that which might be expected from the above formula. In practice, the most favorable test frequency for a given rope can be arrived at only by investigation. A series of coils of different frequencies are tried out one at a time until one is found the characteristics of which are such that the core loss varies in direct proportion to the load. Only a coil having such characteristics is of real value in the inspection of ropes.

* * *

AS **Cavanagh** in a recent paper has pointed out "In practice a Cyclograph recording is made of the condition of the rope over its entire length when it is first installed, and at defiinte intervals

thereafter. Tests must be made with a known load on the rope. Any variation from the standard recorded pattern at any given point in the length of a particular rope at a definite load can only be due to the beginning of plastic deformation. A limit can be set for allowable variation of the instrument from normal (fig. 4). A reading beyond this limit at any point in the rope will indicate that it is no longer safe to use."

* * *

A study of **Cavanagh's** work in this field suggests that it might be more reasonable **at the moment** to say that any variation from the standard recorded pattern at any given point in the length of a particular rope at a definite load can only be due to a **change in state** at this point of the rope. This is so because the Cyclograph is able to detect in objects more homogeneous than ropes a threshold of plastic deformation In such objects, if made of ferro-magnetic materials, the first effect on the magnetic properties of the application of increasing stress is the alignment of the magnetic domains. Speaking generally, alignment is complete when the applied stress reaches somewhere between one third and one half of the limit of proportionality of the metal or alloy under test. The removal of stress before alignment is complete permits the magnetic domains to return to a condition approximating, but not duplicating, their original random state. However, the original random state cannot be completely duplicated, unless the object under test is vibrated. The difference in magnetic properties resulting from the partial alignment of the magnetic domains under repeated application of a low load is scarcely detectable by the Cyclograph under practical operating conditions. But complete alignment is clearly established by its means. Even when complete alignment of the magnetic domains results from the application of stress to the object under test, the original random state can be partially restored by removing or reducing the stress and vibrating the test sample. In mine hoist and elevator operation normal vibration accomplishes this. The instrument is unable to detect any difference between the object now and the object before the test started, hence no change is produced in the recorded pattern by stresses in these ranges. There are then (i) a stress which apparently results in complete alignment of the magnetic domains and which has no permanent effect on the Cyclograph reading, and (ii) a somewhat higher stress — the limit of proportionality — beyond which a definite effect is produced on the Cyclograph can be detected by the usual means. The range of stress between these two values is what we have referred to as **the threshold of plastic deformation.** Once this threshold has been crossed the original condition of the magnetic domains cannot be restored under any circumstances of vibration or other means. The magnetic bonds between domains have been dislocated and their original condition cannot be restored. If any plastic deformation at all recurs then internal stresses

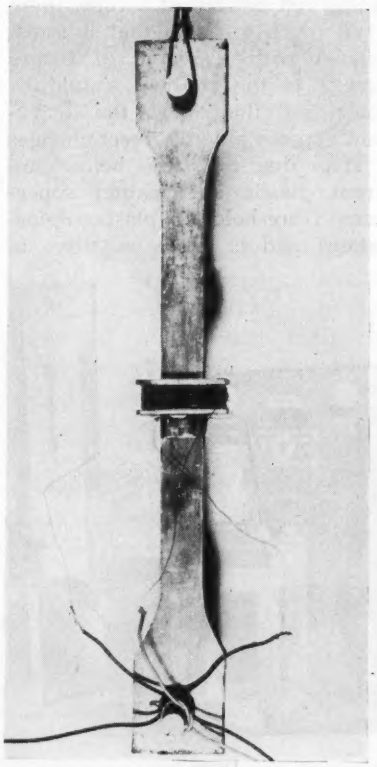

Figure 5.—Creep Test Sample — Pure Lead. Length 10"; Dimensions at center — 1" x ½"; Gauge Length 28 cm.

* * *

interfere with the free movement of the domains. Any object under stress, be it a simple one like the cylinder or tube of homogeneous metal we have already discussed or a complex structure such as a wire rope, may be and occasionally is called upon to operate within the range of stress that we have referred to already as the threshold of plastic deformation.

* * *

TO recapitulate, there are three ranges of operation **under load** for a wire rope—

1. A range in which the rope behaves elastically, both from the magnetic and the mechanical viewpoints. Under repeated loading **and** mechanical vibrating the same Cyclograph reading is always obtained when the standard load is applied to the rope. The upper limit of this range is of the same order of magnitude (p.s.i.) as the endurance limit of such materials as have yet been investigated — it is closely related to the complete alignment of the magnetic domains.

2. A range in which the rope at first behaves elastically from the mechanical, but not from the magnetic, point of view. This range we have referred to above as the threshold of plastic deformation. Within this range small permanent changes in magnetic properties occur even under persistent mechanical vibration.

3. A range in which the rope behaves plastically, both from the magnetic and mechanical points of view. Large permanent changes in magnetic properties now occur. The Cyclograph reading for a standard rope load is much different from that obtained in ranges 1 and 2.

* * *

RANGE 2 is by far the most important in its relation to rope life. The behaviour of a rope operating in the other ranges can be readily interpreted. In range 2, however, stresses in excess of the endurance limits of individual wires or groups of wires may or may not be exceeded. Such overstressing may increase or decrease rope life. It is, therefore, most important that the Cyclograph, or its more recent counterpart the Cable

Tester, should work successfully on material which apparently is in process of becoming work-hardened. On this account a thorough investigation of the effects of overstressing on the core losses of homogeneous materials is being undertaken by P. E. Cavanagh at the Ontario Research Foundation at the present time.

* * *

IT is well known that overstressing can seriously affect the endurance life of steel. The main object of the present investigation is to determine whether a change in endurance life can be predicted by the Cyclograph.

* * *

IN a series of experiments on S. A. E. 1025 steel it has already been found that changes in core losses as recorded by the Cyclograph will follow changes occurring in the material during a normal endurance test.

* * *

SHORTLY after the start of a test on such steel, a stable magnetic state is reached. At first the instrument traces a straight line OA (fig. 5). At point A, however, the core losses increase rapidly with further cycles of stress. The slope of AB is different for various overstresses above the endurance limit and for various conditions in the specimen. Finally, just before failure of the test sample another change in the slope of the core loss endurance cycle curve occurs.

* * *

RESULTS to date indicate that, if endurance life is reduced by previous overloads, the distance OA (fig. 4) is reduced for a subsequent sufficient overload but, in most cases of increased endurance life due to previous overload, OA is equal to or greater than its normal length at the final overload.

* * *

IN service random overloads in ropes cannot be duplicated — there is, in fact, no telling what overloads are applied to a rope in service. It should be emphasized, therefore, that large overloads followed by small overloads are likely to decrease rope life at final small overloads, whereas small overloads followed by larger ones will often result in longer life at the final larger overloads.

* * *

THIS can be said, because it seems to have been well established that "When a high overstress has produced a percentage of damage to endurance life, a subsequent lower overstress may show equal damage in some cases and higher damage in others. On the other hand, when a low overstress is followed by a higher overstress, the indications are that the damage to endurance life is less at the final stress than at the initial. When the initial overstress is low and the number of cycles of overstress is not too large, the effect of the initial overstress may actually increase the life of the final stress. The harder, stronger steels seem to be more sensitive to damage than the softer, weaker steels." (*Kommers; Proc. A.S.T.M.* 1945, *Vol.* 45, *pp.* 532-541.)

* * *

WHATEVER the fundamental cause of local change in the Cyclograph pattern of a rope, there is not much question that it is associated with a region of future damage to the rope. It should be emphazised that, since the instrument appears able to detect changes in state due to stress before apparent plastic deformation supervenes (threshold of plastic deformation) and is highly sensitive to the occurrence of plastic deformation, its value as a tool of a continuous non-destructive testing is clearly established.

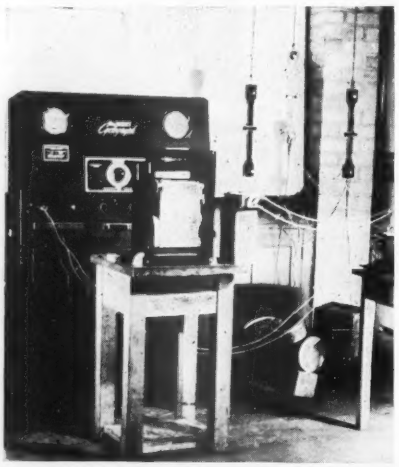

Figure 6.
Creep test set-up showing samples suspended from beam, motor driven switch, Cyclograph and recorder.

* * * * *

* * *

THE sensitivity of the instrument to plastic deformation has been nicely illustrated by applying it as an indicator in creep tests on lead. The samples used in these tests were of the form (1″ x ½″ section) shown in figure 5, which is a reproduction of a photograph of one of the test samples with its pickup coil in position near the centre of the 28″ gauge length. The test samples were hung from a suitable support and loaded by means of dead weights, as shown in figure 6. One of the samples, that on the left in figure 6, was, during the first series of tests, used as a control sample.

* * *

THE pickup coils on each of the samples were identical and operated at a test frequency of 10kc. A mechanical three-way switch was constructed to connect the test coils with the Cyclograph successively. The output of the Cyclograph was recorded on an Esterline-Angus 5 mil. meter. The meter was driven from the mechanical switch. The meter record consisted of a series of three curves, one for each sample, the time interval for each curve being thirty seconds.

* * *

THE weights applied to the test samples were 150 lbs. and 250 lbs. (300 p.s.i. and 500 p.s.i.) respectively. The changes in the gauge length were measured by means of a cathetometer. The test was conducted in an air-conditioned room, the temperature of which remained reasonably constant in the close neighborhood of 72° F. The results of the tests are shown graphically in figure 7.

* * *

AN interesting feature of the Cyclograph graph for the more heavily loaded sample is the rapid initial decrease in reading and the subsequent equally rapid increase to the original value. This feature characterized the graph for the unloaded sample, when, at the conclusion of the first series of tests, it was loaded with a weight of 250

lbs. — the Cyclograph graph obtained was a replica of that shown for the 500 p.s.i. sample in figure 7. A tentative explanation of this phenomenon is as follows — the initial decrease in meter output would normally be looked for if lead was subjected to tensile stress. The subsequent rapid increase to the original value may be due to the establishment of a constant rate of recrystallization in the sample. Lead which is being deformed plastically at room temperature is known to recrystallize. It is conceivable, therefore, that, within an hour or two of the application of sufficient stress to a creep sample of lead, a state would be reached where the effects or further deformation on the Cyclograph would be counterbalanced by those recrystallizations. Once this state had been reached the Cyclograph — time graph, would follow a normal pattern.

* * *

MUCH work remains to be done in the above connection. However, the fact has been established that the Cyclograph can detect very small rates of creep, rates of creep such as might, for example, be encountered for short periods of time during the stressing of materials above the limit of proportionality.

* * *

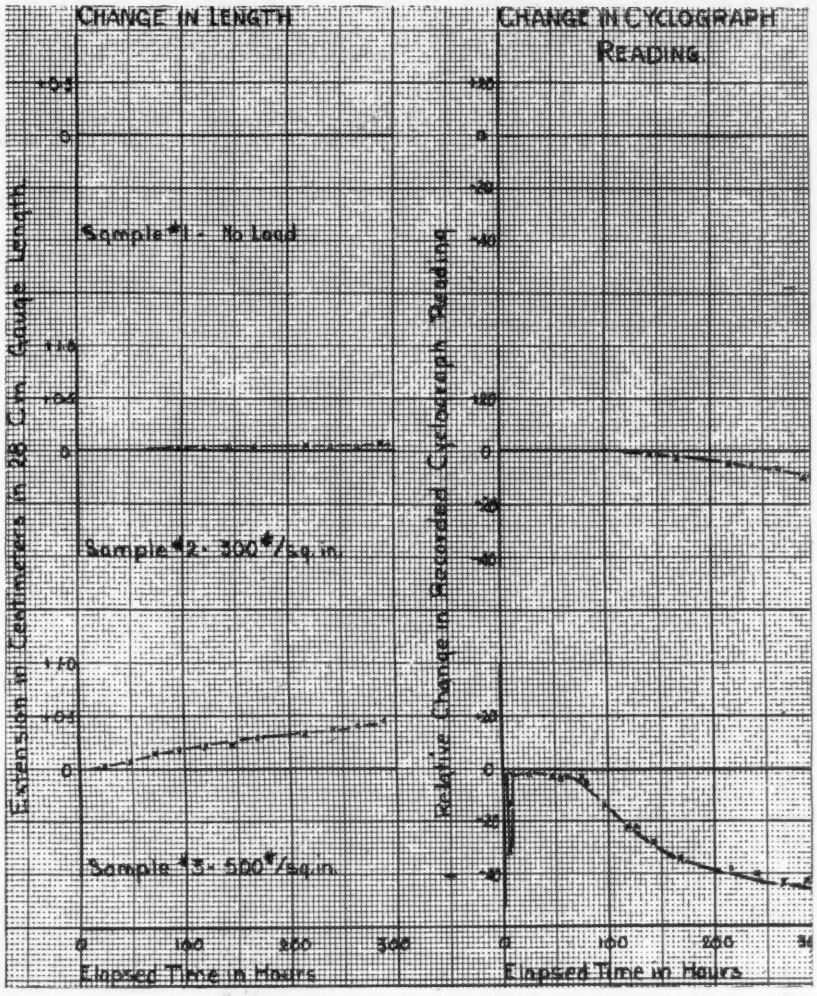
Change in Length
Change in Cyclograph Reading
Sample #1 - No Load
Sample #2 - 200 #/sq. in.
Sample #3 - 500 #/sq. in.
Extension in Centimeters in 20 Cm. Gauge Length
Relative Change in Recorded Cyclograph Reading
Elapsed Time in Hours
Elapsed Time in Hours

Fig. 7.

THE question may arise whether a rope will finally fail at a point indicated on the Cyclograph record. In this connection it should be observed once again that overloading for a short time may actually increase the fatigue life of a rope. If the rope as a whole is overloaded and the Cyclograph indicates a change in state at one point, it is not impossible for this change in state to be neutralized by the strengthening effect of plastic deformation on individual wires in that vicinity, with the result that, under subsequent overloads of the same value, failure will occur at some other region in the rope. In this case no further alteration will occur in the Cyclograph record at the first region of change. Developing change, however, is undoubtedly dangerous.

* * *

LOCAL stress concentrations are, of course, recorded on the Cyclograph record. If the overload at these points is continued long enough, failure of the rope will eventually occur there in spite of any improvement in wire strength due to plastic deformation.

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Some Unusual Conditions Encountered in Cold Heading Products

by F. W. Nobbs, Chief Inspector
The Steel Company of Canada, Ltd.,
Toronto, Canada

In the past seven years all of us have been required to do unusual things and we have thus encountered unusual conditions. This paper is an account of some such conditions encountered by the writer and are presented with the purpose of passing on practical information to those interested in the progress of cold headed products.

Aluminum Alloy 17S

IN the early part of the war, the majority of aircraft rivets produced in Canada were made of the 17S Aluminum Alloy to British AGS specifications.

* * *

A typical chemical analysis of this alloy is as follows:

%Al.	%Cu.	%Fe.	%Mg.	%Mn.	%Si.
92.8	4.0	.7	.5	.7	.8

%Zn.	%Cr.	%Ti.	Bal. Impurities %
.1	.1	.15	.15

* * *

SEVERAL millions of these parts were produced to a high standard of quality without undue trouble providing good equipment was used and a high manufacturing standard was maintained.

* * *

THE wire was purchased in the annealed condition and cold headed on standard double blow cold headers. The rivets were then anodized to improve corrosion resistance and shipped to the customer. This type of rivet was then solution heat treated just prior to driving while the metal is readily workable and then age hardening affected at room temperature in the final assembly.

* * *

SOON, however, the demand for U. S. rivets to AN standards became prominent. The main difference between the AGS and AN types was that the shank diameter limits on the latter were slightly higher.

* * *

SHORTLY after production was started on the new type, some customers encountered trouble in driving the rivets, in that the driving heads would not form properly and tended to form a lopsided head.

* * *

METALLURGICAL examination of unsatisfactory batches of rivets revealed that an abnormal grain size was present in the shanks, while rivets from satisfactory batches showed some evidence of enlarged grains but to a much less degree.

* * *

Figures 1 to 5 are typical of many rivets examined.

* * *

ON examining these, it is interesting to note that—

Fig. 1 Fig. 2 Fig. 3

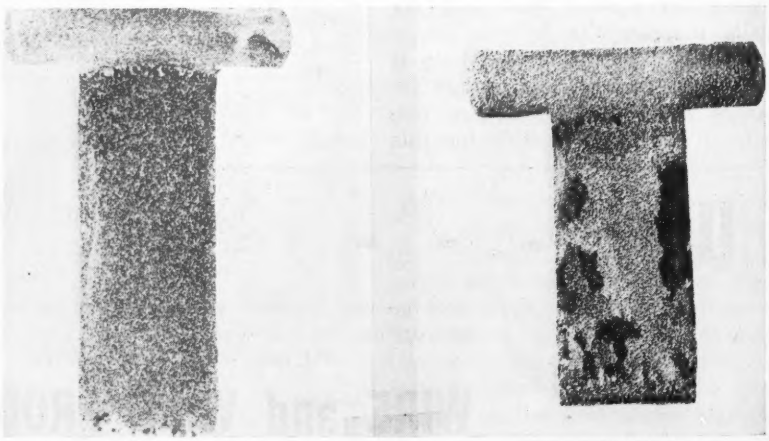


Fig. 4 Fig. 5

1. **All rivets show some evidence of enlarged grains at the end of the shank and in the shank near the head.**
2. **All rivets show a normal grain condition in the highly stressed areas of the heads.**
3. **In figures 1, 2 and 4, the major portions of the shank show a normal grain condition.**
4. **In figure 5, a slight grain enlargement is present at the top centre of the head in the region of the small identification dimple.**

* * *

AS it was known that this alloy would exhibit abnormal grain growth if cold worked within a critical range prior to heat treatment, further investigations were then done in which the actual shank diameters of rivets were measured, the rivets solution heat treated, then sectioned and examined. As the wire size used was constant for each diameter, it was possible to determine the extent of cold work done on the shank of the rivets during cold heading and correlate this figure to the macro-examination results.

* * *

FIGURES 6, 7, 8, 9 and 10, show representative macrophotos of some of these rivets. The amount of cold work each of these had received, is as shown in table A.

* * *

IT is apparent that with this particular material abnormal grain growth commenced somewhere between 7.2 and 8.1 percentage of cold work.

* * *

IN accounting for the condition described in the above item 1, it was determined that the grain growth at the junction of the head and shank was due to the fact that this region was cold worked within the critical range due to being in a position between a minimum amount of cold work in the shank and a maximum in the head. The consistent presence of this condition in the ends of the shank was due to a cold working effect caused in the shearing operation and a slight bell mouthing of the die created in the lapping of same. This bell mouth effect would not be detected by measuring the finished rivet as same is ejected from the opposite end of the die.

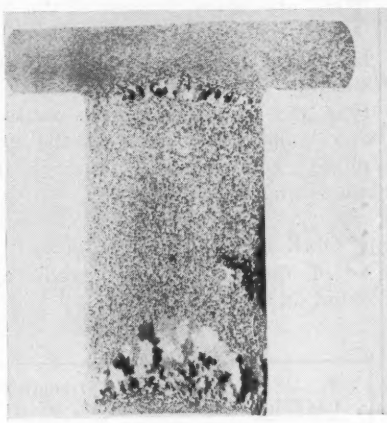


Fig. 9

Fig. 10

TABLE A

Figure	Wire Size	Shank Size	% Cold Work
6	.183″	.188″	5.1
7	.183″	.189″	6.3
8	.183″	.191″	8.1
9	.183″	.190″	7.2
10	.183″	.191″	8.1

IN item 2, the headed region was subjected to an amount of cold work exceeding the maximum critical point.

* * *

IN item 3, the shank was cold worked to a point below the minimum critical range.

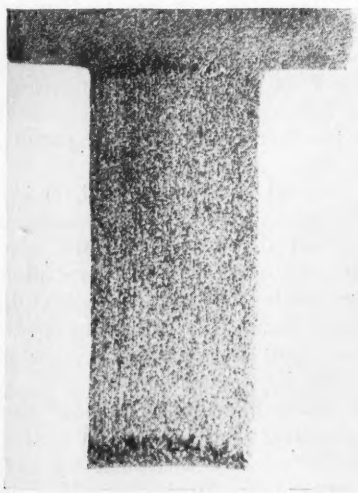


Fig. 6

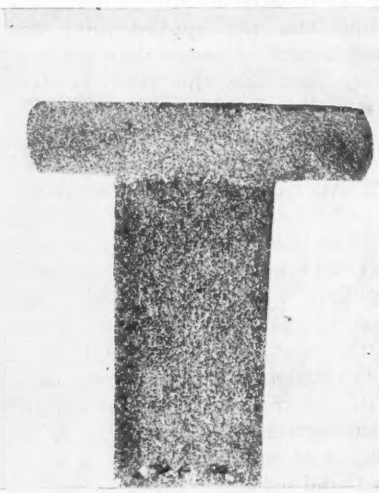


Fig. 7

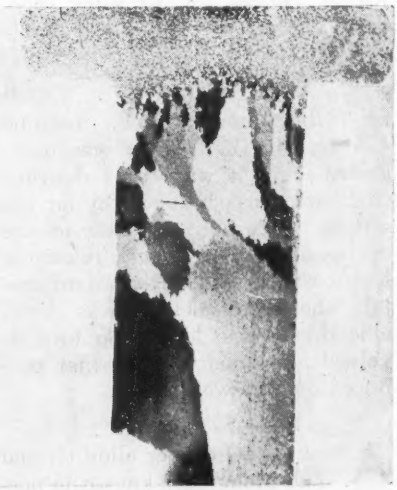


Fig. 8

IN item 4, the amount of cold work was just sufficiently inside the critical range to cause a slight amount of grain growth.

* * *

TO determine why this condition was apparent to an undesirable degree in rivets to AN specifications, it was seen that as the wire sizes were the same in making both AN and AGS rivets the maximum shank diameter limits in the former were largest and sufficiently high so that those rivets made to, or close to, the high limit were cold worked within the critical grain growth range.

* * *

IN developing a correction of practice to eliminte the presence of enlarged grains after heat treatment, closer die making tolerances and wire size changes were made but were found to be uneconomical and only partially successful. Finally the wire drawing practice was changed so that the final draft was made after the last annealing operation and was sufficient to cold work the material beyond the maximum of the critical range. This practice was completely successful and thus adopted.

K. R. Monel Metal

EARLY in the year 1941, the naval and air forces required substantial quantities of corrosion-resistant bolts and screws possessing ultimate strength properties of 125,000 to 145,000 psi. In some cases it was essential that these parts also be non-magnetic.

* * *

AT that time the screw machine capacity in Canada was overloaded and it was thus desirous that such parts be made by an upsetting process. Also due to the decreasing supply and relatively high cost of corrosion resistant metals, the latter method was desirable due to the low scrap loss involved as compared with that produced on screw machines.

* * *

A new nickel-copper alloy termed KR. Monel was known to possess all of the above properties after suitable heat treatment, but at that time had never been subjected to cold heading. This alloy is a modification of the more commonly known Monel and K Monel metals. The nominal chemical compositions of these alloys are as shown in Table B.

TABLE B

Grade	%Ni.	%Cu.	%Fe.	%Mn.	%Si.	%C.	%Al.
Monel	67.0	30.0	1.4	1.0	0.1	0.15	—
K Monel	66.0	29.0	0.9	0.85	1.0	0.15	2.75
KR Monel	66.0	29.0	0.9	0.85	1.0	0.30	2.75

THE aluminum content of the latter two alloys enables them to be artificially age hardened when suitably heat treated. In the KR type, the carbon content is doubled and is largely present in the graphitic condition to improve the machining properties.

* * *

SOME typical physical properties of the KR Monel grade are listed in Table C.

TABLE C

Condition	Yield Strength Psi .2% offset	Ultimate Strength Psi.	% Elongation in 2 ins.	% Reduction of Area
Cold Drawn	39,000	91,000	36.5	57.7
Heat Treated 1	90,000	140,000	30.0	50.0
Heat Treated 2	111,000	161,000	27.0	46.0
Spring Temper Heat Treated 3	———	200,000	3.0	—

THE material originally supplied for cold heading was annealed, pickled and limed wire having an ultimate strength value of approximately 100,000 psi. A wire drawing draft with a lubricating compound was not applied after the final anneal in order that the material used on the cold headers would be in the softest possible condition.

* * *

TRIAL runs were made on standard double blow, solid die cold headers. However, as it was known that this material work hardened rapidly, wherever possible the capacity of the machine used was to the next largest diameter. Thus a ¼" diameter bolt was run on a 5/16" machine and likewise a 5/16" diameter on a ⅜" machine. A lubricant of equal quantities of white lead and machine oil was applied to the coil on the wire reel. The first type of headed blank made was for subsequent processing into hexagon head Cut Thread type of bolt with rolled threads. The extruding for roll threading was done in the cold heading operation using high speed and tungsten carbide dies. For reasons given below, the above procedure was changed to produce a Cut Thread type of bolt with cut threads using high speed dies in the cold header.

* * *

THESE test runs revealed several important factors which are listed below—

1. Stress distribution in the heads revealed by sectioning and etching same in warm aqua regia, was normal and well distributed providing care was taken in forming the first and second upsets. See figure 11.

* * *

DIE life on extruding for roll threading was low in that for high speed and tungsten carbide dies the average counts produced were 2,000 and 10,000 respectively. The failure of the dies occurred at the position of the extruding angle.

* * *

A logical theory proposed for explanation of this condition was that the surface of the wire contained a film of the very abrasive oxide of aluminum Al_2O_3, formed during the annealing operations in the wire practice.

* * *

IN order to compensate for this abrasive being present, a further quantity of wire was made up with a copper-soap lubricant applied in a "skin-pass" after the final an-

nealing operation. White lead and machine oil was also applied to the wire at the cold header. These lubricants were a definite improvement but it was evident that for economical extruding at the cold header a still better lubricant was needed.

* * *

HOWEVER, it was found that an economical die life could be obtained by making full size blanks for cut threading. This is explained by the fact that in this operation a straight hole die is used and the wire size is at least .002″ smaller than the die hole. Thus the only wear on the die is on the upsetting of the wire in the die and the ejection of the headed blank.

* * *

IN order to get into production quickly, this latter method was adopted.

3. Longitudinal cracks were formed on a large percentage of the headed blanks which on investigation were found to have originated from surface defects in the wire, some of which would not normally be considered of a serious nature.

* * *

IT was felt that due to the rapid rate of work hardening of this alloy, even the small defects were serious stress raisers which resulted in fracturing of the metal during the upsetting. Hardness tests done on the wire and on the headed portion of the blank showed that in upsetting, the material work hardened from Rockwell C 17 to C 31, an increase of 14 points. Similar tests done on headed blanks made from A.I.S.I. — C 1035 and A 1335 steels showed an increase from Rockwell C 14 to C 24, a difference of 10 points. Figures 12 and 13 show the microstructure of a longitudinal section at the point of highest stress concentration in the heads in similar types of bolts made from KR Monel metal and A.I.S.I. — C 1035 steel respectively.

Fig. 11

HOWEVER, due to the longitudinal nature of the cracks in the heads, it was suggested that if wire of excellent surface quality could be developed, the cracking in the heads would be eliminated. Our material suppliers did an excellent job in this regard, as wire made to a higher surface quality standard, upset without fracturing.

4. Trimming the round headed blank to a hexagon shape was done in automatic trimmers of modern design, at the same speeds as used for steel blanks. A stream of sulphur base cutting oil was applied to the blank when in position for receiving the trimming die.

* * *

IT was found that a well defined, smoothly finished hexagon head could be made providing the diameter of the headed blank ranged from 1/64″ to 1/32″ greater than the width across the corners of the trimmed blank.

5. Threading was done in production on hand fed cut threading machines with lead screw attachments. Smooth, well defined threads to SAE Class 3 and British Standard No. 84 medium fit limits, were made in production.

* * *

TRIAL runs made on automatic roll threaders showed that this material would roll thread satisfactorily and produce an excellent form of thread. These runs were not long enough to give an indication of die life to be expected in production.

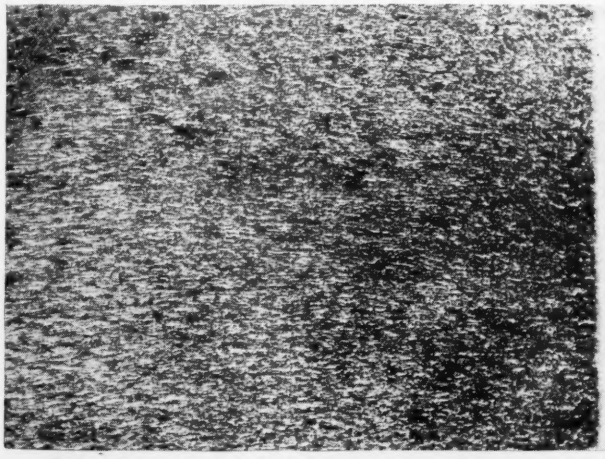


Fig. 12

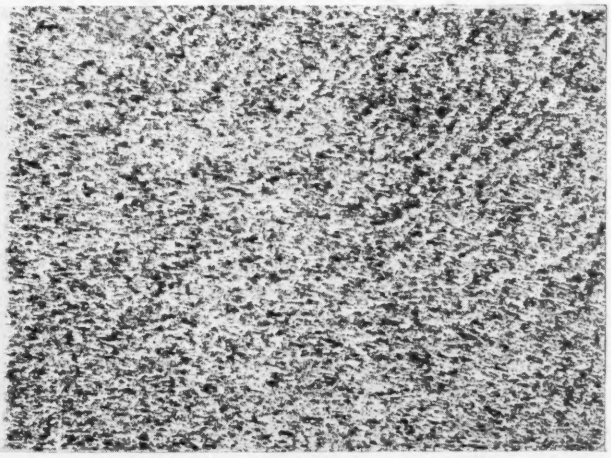
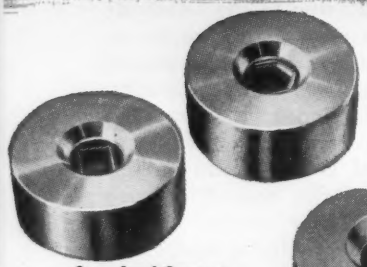
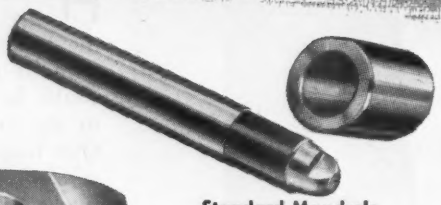


Fig. 13

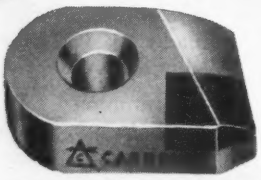
A COMPLETE RANGE OF DIES



Standard Square and Hex Dies



Standard Mandrels and Mandrel Nibs



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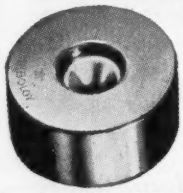

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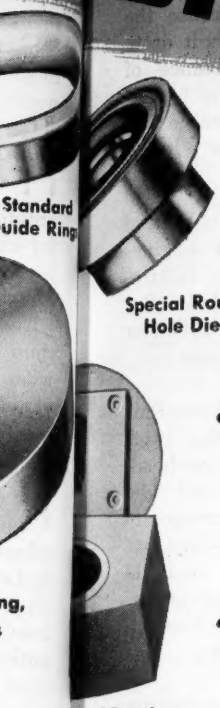

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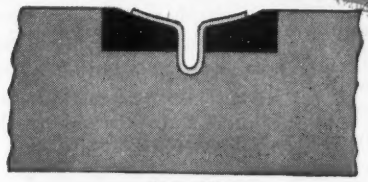

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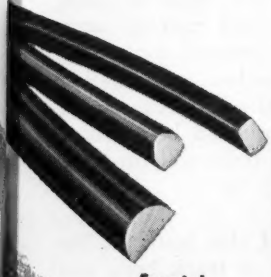
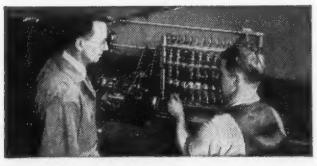


Special Shape Die



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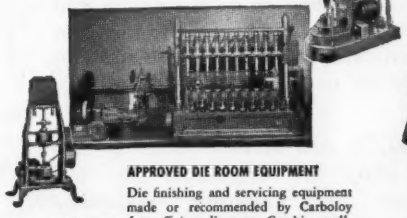

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ALL threading was done prior to final heat treatment as the latter process coated the bolts with a corrosion resistant film.

* * *

6. Heat treatment to obtain the required final physical properties was done in a well sealed, electric, box type, convection draw furnace.

* * *

THE original cycles consisted of hardening cycle only, of heating to 1080° - 1100° Fah., holding at heat for 1½ hours and quenching in a 5% solution of alcohol in water.

* * *

THIS cycle gave the required physical properties in the test wires but on treating the bolts similarly, it was found that varying hardness resulted within one bolt and the ductility and impact tests were inconsistent.

* * *

THE above condition was due to the fact that the final hardness obtained on this alloy by precipitation hardening, is in direct relation to the initial hardness prior to this treatment. Thus the different degrees of hardness within one bolt, resulting from work hardening in the cold heading operation gave a non-uniform condition after the hardening cycle.

* * *

IN order to produce the parts with uniform hardness, an annealing cycle was given by heating to 1525° - 1550° Fah., holding at heat for five minutes and quenching in water. Precipitation hardening was then done. Tensile, bend and impact tests done on parts thus treated gave physical properties within specification and consistent with results on test wires.

* * *

BOLTS and screws made of this alloy are applicable for use where high corrosion resistance and/or non-magnetic properties are desired at higher stresses than normally expected of Monel metal fasteners. They are also applicable in positions where K. Monel fastenings machined from the bar are being used.

* * *

Improving the Fatigue and Tensile Properties of Roll Threaded Steel Bolts

THE forming of threads by means of rolling steel of circular section at approximately pitch diameter size between hardened dies has proven to be the most economical means of threading the majority of steel bolts. This economy is effected due to the high speed of processing, the saving of material and the long life of dies.

* * *

SMITH has shown that roll threads have higher ultimate strength and fatigue resistance than cut threads and Staedel proved that threads rolled after heat treatment have a higher fatigue resistance than threads rolled prior to heat treatment.

* * *

THE majority of cold upset bolts are heat treated in some manner in order to obtain physical properties suitable to the customer's needs and/or relieve stresses created in the forming of the head.

* * *

AN interesting practical instance of the effect of roll threading after heat treatment was encountered in the making of track bolts for Canadian Army snowmobiles. This vehicle was propelled by means of flat rubber treads on which high cleats were mounted to effect traction. These cleats were fastened to the tread by means of special carriage bolts held in such a position that they were subjected to severe tension and bending stresses.

* * *

THE bolts were originally made of A.I.S.I. C-1035 steel, cold upset from a wire size of approximately thread pitch diameter size, on standard, double blow, open die, cold headers. The threads were then rolled on to National Fine Class 2 tolerances in reciprocating roll threaders. The threaded bolts were then hardened and drawn back to a core hardness range of Brinell No. 269-302.

* * *

UNDER service conditions a large number of bolt failures resulted from fracturing of the bolt threads due to fatigue.

* * *

THE alternatives correcting this condition were to increase the size and/or design of the bolt or to increase the fatigue resistance of the unsatisfactory bolt. The former method was the least desirable due to the resultant extensive change in design of the track.

* * *

IT was known that the bolts and studs used in aircraft engines had shown fewer fatigue failures when threads were rolled after heat treatment than those rolled or ground before heat treatment.

* * *

AS a result of this information, the processing on the track bolts was changed in that the headed blanks were hardened and drawn to a hardness range of Brinell No. 217 to 255. This reduction of hardness was made in order that life of the threading dies would not be materially impared on subsequent roll threading.

* * *

A comparison of the properties of the two methods was made by assembling 400 bolts of each type in vehicles and running same over a proving ground for a distance of 1609 miles. Investigation revealed that failures occurred on 384 bolts roll threaded before heat treatment and 4 bolts roll threaded after heat treatment.

* * *

AS a result of this test run, the processing of track bolts was immediately altered to obtain bolts roll threaded after heat treatment.

* * *

IN analyzing the reasons for the increased fatigue resistance, we must consider the reasons why parts fail in fatigue. Almost all fatigue failures result from tension stresses. These failures generally originate at the metal surface, particularly where the design of the part allows high local surface stresses. An exception to the above is where severe sub-surface defects are present. Also the stress concentration at the metal surface is considerably higher than the average cross-section. This latter condition is particularly effective in

the case of threads, which are sharp surface discontinuities of high stress concentration factor.

* * *

THE increased fatigue resistance due to roll threading after heat treatment is generally attributed to—

1. **Slight surface defects such as pitting or scaling resulting from the heat treatment process are largely eliminated by the subsequent working of the metal.**
2. **The surface of the metal is work hardened during rolling and thus the tensile strength of the surface is increased. This would be especially effective where decarburization of the metal is affected during heat treatment. Where heat treatment is done subsequent to roll threading, the work hardening effect is lost.**
3. **The cold working of the metal results in the setting up of residual compressive stresses in the thread which act in a compensatory manner to tensile stresses encountered in service.**

* * *

TO explain the origin of these residual stresses, let us analyze what happens to the metal when a thread is rolled on it. The surface and that portion of the core adjacent to the surface are stretched beyond their elastic limit. The centre of the core has not noticeably deformed and may be considered as having zero stress applied. Thus there must be a region which, during rolling, has been stretched to a point below the elastic limit and after release from the rolling dies, sets up residual compressive stresses on the thread. Any subsequent heat treatment would remove the presence of such residual stresses.

TABLE D

Quality and Condition	Ultimate Strength — 1000 lbs. Psi. Process Ann'd. at 1000 F.	Process Ann'd. at 1075 F.	Process Ann'd at 1150 F.
C-1005 Roll Thread before Heat Treat	70-77	51-59	45-54
C-1005 Roll Thread after Heat Treat	77-87	62-64	51-62
C-1010 Roll Thread before Heat Treat	79-83	65-68	61-68
C-1010 Roll Thread after Heat Treat	80-91	77-90	64-68
C-1020 Roll Thread before Heat Treat	95-97	85-88	66-67
C-1020 Roll Thread after Heat Treat	103-109	96-99	78-89

CHEMICAL ANALYSIS

Grade	%C	%P	%S	%Mn.	%Si.
C-1005	.050	.015	.050	.27	.002
C-1015	.112	.017	.026	.50	.002
C-1020	.192	.018	.025	.50	.213

* * *

IN order to determine the effect of roll threading subsequent to Process Annealing (stress relieving) treatments on the tensile strength of low carbon steels, we conducted tests on threaded wires of grades A.I.S. C-1005, C-1010 and C-1020. The samples were made by taking Cut Thread diameter wire and extruding the portion to be threaded, then roll threading and process annealing and vice versa, at temperatures of 1000 Fah., 1075 Fah. and 1150 Fah. All samples were extruded and threaded on the same machine set up to ensure uniformity of treatment within each grade. Ultimate strength values were calculated on mean diameter areas. (See Table D).

* * *

FROM the above results it is seen that in each case, roll threading after process annealing gave higher ultimate strength values that roll threading prior to such treatment. Also that the process annealing temperatures have a marked effect upon the resultant ultimate strength properties of the threads.

* * *

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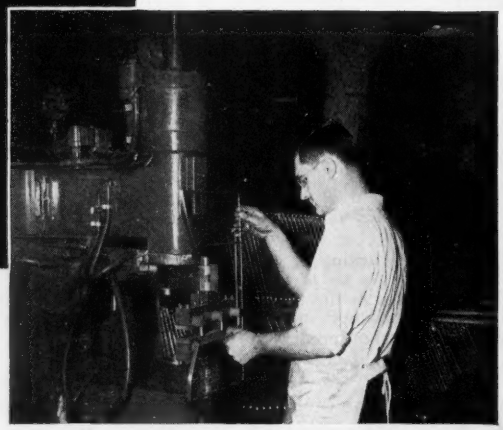
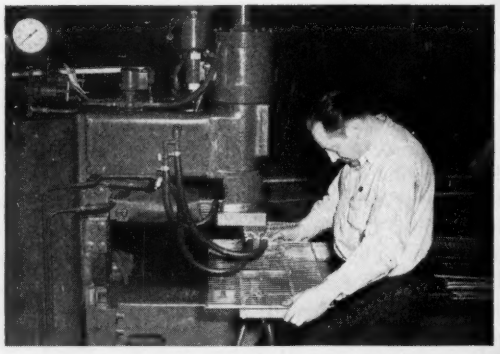


3 simultaneous spots weld .050″ channel to .225″ wire frame on these refrigerator trays.



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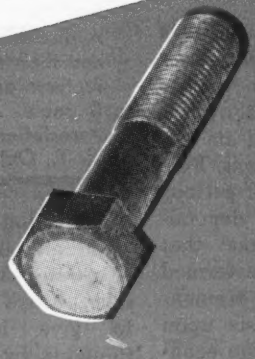

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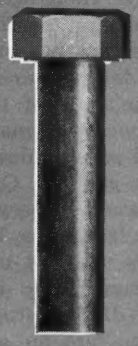

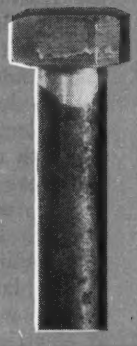

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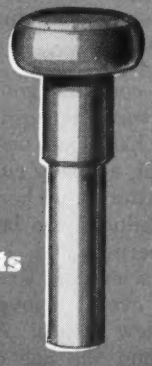

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Some Theoretical and Practical Concepts of Synthetic Insulants in the Cable Industry

by H. D. Short, B.Sc., P.Eng.
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A discussion of synthetic insulants and their advantages to the manufacturer and user of electric wire & cable. A paper for the Wire Association Convention at Buffalo, N. Y., October, 1946.

DURING the preparation of this discourse what appeared to be a fact came suddenly to my mind. And as I mulled it over I became more convinced of its genuineness. This is what it was. Few people, in even their more serious moods appreciate the great dependence of our civilization upon that class of materials which are termed electric insulants; and the tremendous responsibility that rests upon these materials to sustain the economy of that civil state.

* * *

BALZAC once said that woman's virtue was man's greatest invention. That learned deduction is best not denied; but if it be truth then assuredly **Michael Faraday's** discovery of electromagnetic induction will rank the second highest among the greatest of man's achievements from the time some transcendent intellect, in the dark ages, devised the first wheel — the probable starting point of civilization. That this is so cannot be easily disclaimed; for some reflection will soon reveal that the civilized structure man has erected is modelled around, and motivated by, this same electromagnetic force; which sired the electrical industry of today. Long before **Faraday** was born, **Archimedes** upon discovering the principle of the lever remarked that if given a place to stand he could move the world. Indeed, it was a powerful prime mover that he had conceived; none the less it is but a puny thing when compared with the resultant magnitude of the driving power given to the world by the majestic genius of **Faraday** and so largely made manifest by the poetic brilliance of that oft forgotten man of science, **Nickola Tesla.**

* * *

IN assaying the impact, or impress, of any one event or individual effort and its succeeding influence it is always well to give substance, to give background, to one's thoughts by reminiscing awhile on the related historicity. Then again, very often, it is only by looking back that the future can be foretold. And so let us for a moment or two look back on some of the chronological mile-stones that mark the path of electrical science down the years of the 19th century. One of the most fascinating observations to be gleaned from this bit of embellished past is that not until the law of electromagnetic induction was revealed did the study of electricity converge into an applied science beginning with **Lord Kelvin,** to most accounts, the first great electrical engineer.

* * *

THE stone age had come and gone, the iron age was tottering, **Volta's** electric pile has been used to exhibit the arc light, a steady current derived from batteries has been realized, **Ohm** had deduced the law which has since perpetuated his name, the natural scientists were striving hard and events moved swiftly toward a new epoch. At last it broke forth and the age of electricity was born of the midwifery of **Faraday,** who in 1831 demonstrated how electrical energy could be transformed into mechanical energy and propounded the governing precepts. In his studies of induction **Faraday** not only showed that the phenomenon could be greatly intensified by winding the conductors into a coil and insulating adjacent turns, but he elucidated the importance of the insulant in propogating the electric force. Whereupon he availed himself of materials commonly employed for other purposes, and wrapped the conductors with calico and cotton tapes; establishing one of the first, if not the first application of a material as an electric insulant. Then came the last half of the amazing 19th century and with it the inception of electrical engineering. Inventions and schemes to make use of electricity soon followed. **Swan** in England, and **Edison** in America invented an electric lamp; the transmission of electrical power was found practical; a plan to develop electrical energy from the water fall at Niagara was taking shape, and by 1886 a company has been incorporated to exploit this natural resource adopting in 1892 the polyphase system perfected by **Tesla** five years before.

* * *

FROM this early beginning the science of electricity grew at a tremendous rate, vastly modifying the whole social order and swiftly evolving the present day state of kaleidoscopic affairs which we call modern civilization with all its comforts, controversies, and conveniences. New applications of the science and increasing demands for electrical energy developed in striking fulfilment of Heraclitus' aphorism of two thousand years ago. "All is flux." Yes, in truth, modern civilization is literally permeated from all sides with electromagnetic flux, **Faraday's** tubes of induction —humanities greatest legacy from endowed research.

* * *

AND although the need for insulated conductors kept apace

of this evolution the cable maker was obliged to seek insulating materials from among the commodities of commerce, such as cotton and silk yarns, paper, bitumen, natural oils, gutta percha, amber and eventually rubber. And by numerous schemes and a deal of improvisation he adapted these materials, in various forms and combinations, to the insulating of electrical conductors. Until comparatively recent times these materials have remained the standard insulants of the cable industry. In this respect it is of singular interest that of all these materials the most widely used — viz, rubber, rosin, gutta percha, amber, and bitumen— have been those which Nature, in her foresight, created as natural plastics long before man by his ingenuity contrived to synthesize them. Today, however, the picture is rapidly changing and we have materials being produced with the prime requisite of a good insulant. Never before, in the whole 100 year history of electrical engineering, has the electrical engineer and cable maker had at his disposal such an array of electrical insulations, synthetic and otherwise.

* * *

AND it is a tragic travesty of fortune that the progress in the evolution and adaptation of insulating materials made in the last few years should have been conspired and inspired by the arms of Mars embracing those blood brothers of the Sons of Martha, whom we know as the physicists and chemists. The synthetic chemist, stimulated by the needs of war, and working with the waste products of the oil and coal industries, displacing atoms here, attaching atoms there, increasing or decreasing molecular weights at his bidding, has succeeded in producing a vast number of synthetic plastics having an enormous range of properties and uses. Witness the whole field of synthetic rubbers and resins developed from the polymerization of single molecules of methane, the simplest hydro-carbon unit to which is also related natural rubber. To this accomplishment our wealth of knowledge of atomic physics has contributed to a very large degree. In strong corroboration of this statement, to cite but a single piece of evidence, is the present day design of high voltage cables which the physicist's researches, in the electrical behaviour of gases and oils, made possible in the first instance.

* * *

SO far have the scientific frontiers been extended in this direction that it is beyond question but that we are approaching an era, wherein the engineer, with the aid of the chemist and physicist, will be able to design on atomic principles specific insulants for a particular purpose, by molecular prearrangements of his own making. Even now, with the scientific information already garnered, as a result of the studies of **Maxwell, Debye,** and later investigators, some of the important electrical characteristics of many substances can be ascertained mathematically from their thermal and optical properties.

* * *

THE electrical age has reached its zenith. On July the 16th, 1945 in one fell swoop the age of atoms was delivered into the parental arms of man with a cry heard around the world; the after-birth of which will ebb and flow so long as animated nature exists. At long last transmutation of the elements has succeeded, most certainly an omen of far reaching import to every electrical engineer. We have heard many trepidations expressed on many sides of the age that has emerged. But stay — history always repeats itself and at the stepping stone of every new age civilization has paused, weighed waringly the future, then, armed with ingenuity gone onward to await with renewed courage the onslaught of events.

* * *

BUT the intellectual achievements of the past and innate ingenuity alone will not suffice to carry this era forward. Electricity is a vital, integral part of man's very habits and existence within the edifice he has created; and its uses are made possible solely by the restraining influence he has brought to bear upon it from the proper use of dielectric materials. So essential are these materials, ipso facto, that the future applications of the whole gamut of natural science is drastically hampered by their present shortcomings. New and improved insulating materials brought about by the labours of our brains duly nourished by the pabulum of well ordered, systematic thought, experimentation, and dissemination of knowledge, are sorely needed; and it is a counsel of mental stagnation to assume that they will not be achieved. Thus, if I may presume so to speak, the cable industry looks forward from the brink of this new age with great expectations of things to come; and with full appreciation of its major influence on the future development of electric cables.

Electric Cables and the Transmission of Electric Energy

THE making of electric cables, and the scope of engineering necessarily associated with it, is in many ways, a peculiar and complicated art. For, it at once involves not only electrical engineering, but a broader range of the sciences which includes a knowledge of metals, and the chemistry and physics of non-metallic materials. In fact it is quite apparent, after close scrutiny, that in no other branch of electrical engineering, as that associated with cable making, do chemistry and physics play such a major part.

* * *

ELECTRIC cables, are as is well appreciated, the arteries by means of which energy is conveyed from the source of generation to the place where it is to be put to useful work. And since our Society is essentially one based upon economic principles, the cost of transmission is an ever present consideration. Hence it is a sine quo non that any particular cable be designed to carry the required energy with the maximum efficiency consistent with these economic principles. In the early days of the science it was held —and indeed the notion is still prevalent amongst some engineers in spite of our vast accumulation of scientific knowledge to the contrary— that the prime purpose of the insulant

around the conductor was to prevent the loss of electric charge from the conductor and that the conductivity of the copper was of greater importance than the quality of the insulant employed. Today however, owing to the work of **J. H. Poynting** in particular, it is known that the insulant is of much greater significance; and I think it is now generally accepted that the chief role of the insulant is not so much to form a barrier to the loss of charge, but to present a medium by means of which the transfer of energy along the conductor is efficiently effected. The conductor acting more especially as a source of free electrons as well as a guide to the direction of energy flow. And the flow taking place to the physical action of displacements within the medium.

* * *

ALL schemes for the transmission of energy, whether mechanical or electrical, have one thing in common: that is the production of strain at the source of supply and its relaxation or release at the other end where work is to be done — energy expended. That is to say, fundamentally speaking, there must occur a change from potential (or stored) energy to kinetic energy, or the converse, in order for energy of any kind to be transmitted. In the hydraulic system it is pressure that is developed and in the mechanical system it is the strain of the shaft. Similarly, in the case of electrical energy transmission it is the strain in the insulation that is produced.

* * *

IF one were to pursue more fully the physics involved in this analogy it would be found that in both the mechanical and electrical systems the sum and substance of energy transfer is the relaxation of the cohering electrical forces which hold together the electrons, and their nucleus, within the atoms of which all matter is composed. The transmission of energy by electrical means necessitates, as Faraday discovered, an electric field (potential energy) between, and a magnetic field around, the conductors within which electrons are free to move thereby providing the prescribed conditions for an electric current. The rate of this energy transfer, that is the work done in unit time (power) is a product of the gradient of the electric field (dielectric stress) and the intensity of the magnetic field—a relationship which Poynting postulated from Maxwellian theorems.

* * *

IN its simplest sense an electric cable consists of a conductor completely surrounded by a close fitting covering of certain radial thickness, which comprises the electric insulant. Given such an arrangement of metallic and non-metallic materials, and a flow of electrons, several factors come into play worthy of emphasis. Under the subjection of the electric field gradient the free electrons within the conductor are forced to migrate. In so doing these collide with the atomic framework of the metal giving rise to heat energy; and we observe it as resistance, or copper loss. And it is of more than passing interest to know that the energy supplying this loss enters the metal from the insulant around it, which is under the strain of the electric field gradient. One is tempted by these thoughts, to digress here a bit, to reflect that if it were feasible to retain an abundance of supervised free electrons in some sort of a cylindrical enclosure it might well come to be that the metallic portion of this arrangement could be entirely eliminated. Whether or not such a scheme would be amenable to the laws of science is, of course, not within our ken at this time.

* * *

DIELECTRIC materials are inherently good thermal insulations so that the heat energy consequent upon the copper and dielectric losses establishes a temperature gradient through the insulant which is inversely proportional to the distance out from the conductor. Through the insulant at right angles to the conductor there exists a power (energy) flux, or a rate of energy transfer flux, the causa profundus of which is the flow of energy in a direction normal to the electric and magnetic fields; this results in a power flux gradient falling off inversely as the square of the radius. Adjunctively there is the rate of change of the electric field across the insulant noticeable as an inverse function of the radius. Hence, at the inner surface of the insulant we have the maximum dielectrics stress, maximum potential energy, maximum thermal gradient and the minimum power flux — at the outer surface the minimum dielectric stress minimum potential energy, minimum thermal gradient and maximum power flux. Between these boundary regions we have the atomic structure of the insulant material itself, the behaviour of which is biased by the attributes of these phenomena.

* * *

IN nearly all engineering practice the energy used stems from the kinetic energy developed by a falling mass of water; or is derived from the conversion, brought about by combustion, of the inherent potential energy existing between the atoms of oxygen and carbon into the kinetic energy of steam. At the sending end of an electrical transmission system the generators and transformers raise the potential energy of the electric field (or the strain) between the conductors to the highest possible value without occasioning too high losses or disruption of the intervening insulation. At the delivery end work is done by the relaxation of the electric field, which in turn, as already described influences the atomic formation of the insulation maintaining the system. Closely akin to the atomic structure —that is the number and arrangement of the electrons within the atoms— of a good insulation is its chemical composition, upon which are dependent its electrical and physical properties; and the ability of the atomic structure of a material to withstand disintegration, by the potential energy stored in the electric field, although the exact process is as yet obscure, determines its efficacy as an insulator.

* * *

THUS having arrived at these conceptions, and after due consideration of these thoughts, as I have elaborated them, on the trans-

mission of electrical energy and the physical correlation thereto of the assembly of an insulating material and a metallic conductor, I think it is apparent that the cable engineer must at all times be concerned with the inbred dispositions and the related atomic structure of the materials available to him be they natural, or synthetic. And all these various dielectric properties which come under the appraisal of the engineer, determines for him the aptitudes of any particular material to perform as an electric insulant. Quite apart from the purely electrical point of view, a good insulant, to be of use in the manufacture of cables, must also have satisfactory mechanical and thermal properties. Their tensile and compressive strengths, their brittleness, flexibility, liability to chemical attack and ageing under working conditions must measure up to certain standards; which may be in some instances, owing to the usage encountered, quite stringent requirements. The specific characteristics and their relative magnitudes, which comprise the criterions of electrical performance, do not seem appropriate of mention at this time

Some Applications of Synthetic Insulants

UP to this point I have dwelt in a general way on several aspects of electric insulants which to my mind are of importance, not only from the cable industry perspective, but to all who have traffic with insulating materials. In the balance of the paper it is intended to deal, more specifically, with some of the present synthetic plastics which have found considerable use in the making of electric cables.

* * *

AS the Axis crossed swords with the Democracies the cable industry of this Continent was called upon, to the utmost of its production and engineering capabilities, to supply the needs of the armed services, and to design many of the special cables required for the complex communication and control circuits, so vital in engaging the enemy. Confronted almost over night as it were with a loss of a supply of natural rubber, it became necessary to turn our attentions wholeheartedly to the potentialities of synthetic rubbers and synthetic resins. The astounding increase in the production of synthetic plastics in these last five years can be appreciated when it is realized that world's present manufacturing capacity of synthetic rubber is almost one and one-half million short tons annually; additionally, whereas a half a decade ago there were only a few types of synthetic rubbers being made in volume, there are today at least thirty different grades, of eleven chemical categories of synthetic rubbers available from which to choose. In contrast the wild rubber output in the Far East is expected to reach a total of 600,000 tons this year, increasing at a later date to 1,500,000 tons.

* * *

ONE of the oldest of the synthetic rubbers —namely **Neoprene**— was not new to us at the time the rising sun of Japan rose to such heights as to defy the laws of gravity and humanity. It had been in use for a number of years prior to 1939 so that we had available a substitute whose properties were familiar and fully explored. But its uses were limited almost entirely to outside coverings — jackets or sheathes as they are known, and as implied they are used over an assembly of insulated conductors to afford mechanical protection.

* * *

BECAUSE of its poor electrical properties it cannot be classed as a good insulant. This fact can be attributed to its atomic parentage — for within its molecular framework it contains the halogen atom, chlorine. The basis unit (or to the organic chemist monomer) of natural rubber is isoprene, a straight hydrocarbon produced by a photosynthetic process so far known only to Nature herself. By substituting a chlorine atom for a certain number of the carbon and hydrogen atoms the Neoprene compound results. Now whereas, pure hydrocarbons are inherently inert electrically, the inclusion of the chlorine atom introduces polarity to the molecule which results in a depreciation of the electrical characteristics.

* * *

THE presence of the chlorine atoms does, however, give to the Neoprene, just as they do many other organic materials, a strong propensity to resist destruction by burning. And it is because of this fire-resisting property, as well as its comparative immunity to oil and the active rays of the sun, that it first became used in the cable industry as an alternative for rubber compounds. And many an anti-aircraft gun on the torrid sands of Africa, during Montgomery's march toward the under-belly of Europe, owes its effectiveness to the sunlight and oil resisting character of the neoprene jacket on its connecting cable.

* * *

THE great amount of research and experimental work conducted in Germany, Russia, and America during the war and the pre-war period culminated in the present huge production of **Buna S, or GR-S** synthetic rubber, probably the most extensively used synthetic plastic. Another derivative of ethylene, the chemist, by a selection of intricate processes, has achieved in Buna S a plastic quite similar to natural rubber. However, it cannot be said that it is an exact duplicate for, though in many respects it is superior, it lacks many of the qualities which made natural rubber so essential to modern living. Nonetheless, insofar as the cable industry is concerned, Buna S compounds except for some very special cables, are being employed in large quantities.

* * *

IT is no exaggeration that without this product of the synthetic chemist the electrical energy transmission arteries feeding our war machine as it raced to victory would have faltered for want of a "rubber nail," to parody an ancient idiom. On May the 10th, 1941, one bomb dropped on London alone severed 28 cable lines interrupting a total of over five thousand long distance telephone circuits. From the day, over a year ago, when the Normandy beach-

head was established it was necessary to lay some 559 nautical miles of cable, to the Continent from the British Isles, in order to ensure the successful completion of the succeeding operations of our armies.

* * *

Buna S being fundamentally a hydro-carbon, can be comp onded to make an electrical insulant almost the equal of vulcanized rubber compounds; to which, in addition to its rubber-like flexibility, can be ascribed its major uses in the cable industry under present day restrictions. All of the cables common to most every household, such as those connected to one's electric iron, lamps, vacuum cleaner, shaver, radio, and so on can, relatively speaking, be satisfactorily made with Buna S compounds. Generally speaking the following conclusions can be drawn from a comparison of equivalent compounds of natural and Buna S synthetic rubber at low frequencies; (a) the dielectric constant and power factor are equal, (b) insulation resistance of the natural compound is approximately twice that of the other, (c) tensile strength of the natural compound may be anywhere from two to three times as great, (d) elongation about equal, although decreasing faster with age for the Buna S compound, (e) dielectric strength about equal, (f) embrittlement temperature about the same.

* * *

LEAVING the synthethic rubbers we come now to the synthetic resins. Of all such synthetic plastics available those obtained from the plasticization of polyvinylchloride, and the copolymer vinyl chloride and vinyl acetate resin, have found the widest application in the cable industry. They are well known to the general public by their trade names, **Koroseal, or Geon,** and **Vinylite.** Although first discovered about 7 years after the already referred to fundamental researches of **Faraday,** it was not until after 1941 that polyvinyl chloride compounds came into extensive use as an insulant for cables.

POLYVINYLCHLORIDE and the copolymers are powders in the natural state, produced from that versatile and prolific substance ethylene; and only after combining with suitable plasticizers are their latent rubber-like qualities developed. The properties and uses of these compounds under a great variety of conditions have been the subject of an intensive and widespread program in many laboratories. As a result there exist in the literature a large accumulation of scientific information, relating to the various compounds.

* * *

AS their generic name denotes polyvinylchloride and the copolymers contain chlorine atoms, and, therefore, from an electrical engineering point of view they are only a fair insulant. Suffice it here to say, however, that their electrical characteristics are of a degree to warrant use of them, as an alternative to vulcanized rubber compounds, in many cables furnished to the military forces and for other essential requirements; and, in particular, for field telephone cable which was produced in many thousands of miles. Their chemical and physical properties are of a nature to make them immune to many conditions and reagents inimical to rubber compounds — and they are presently finding applications in the insulating of low voltage cables for domestic use and the wiring of commercial and industrial establishments.

* * *

PROBABLY one of the most promising synthetic plastics on the cable industry horizon is also one of the most recently discovered. It is polyethylene, a solid max-like material polymerized at terrifically high pressures from ethylene gas. Experiments in this direction were started as early as 1797 but it was not until 10 years ago that success crowned these endeavours, when a group of British chemists devised a process adaptable to commercial production. Known also as **Polythene,** and the trade name **Telcothene,** it is a translucent pure nonpolar hydrocarbon, having of itself, plastic properties, so that unlike the polyvinylchlorides, it is not necessary to introduce plasticizing agents. Being a pure hydrocarbon, chemically analogous to paraffin wax, it possesses exceptional dielectric properties at all frequencies and at all temperatures up to its melting point: — a characteristic, which along with its plasticity, poses it as one of the outstanding cable insulating materials. Because of these remarkable electrical properties, and a lack of plenitude, its use so far has been somewhat confined to what are known as high and ultra-high frequency transmission line cables. In this field polyethylene, on a variety of certain special cables, has contributed to the many fantastic radio developments of the war. So valuable has been the synthetic plastic, in this regard, that it is difficult to visualize how some of the military radio fitments could otherwise have been made workable.

* * *

IN the period ahead the applications of polyethylene insulants will also be far reaching — for cables so insulated will undoubtedly play a significant part in the radio and television instruments to come. It is also to be expected that advantage of its superior electric characteristics will be made use of in the cables of the higher voltage range, when time again permits of an opportunity for development in this direction.

* * *

THERE are in hand, under investigation, and in the course of unfolding a very large number of synthetic insulants which could be mentioned, as a cursory view of the literature and patent art would soon disclose. But time and tide give no quarter, and, as in everything one does from overloading a cable to making love, it is imperative to know when to stop. Nonetheless, it is, at least, propitious before concluding that attention be drawn to some of the more prominent or intriguing of these materials; namely, the silicone compounds, silicone rubber (Silastic), polystyrene (Loalin, Styron, Lustron), chlorinated styrene (polydichlorostyrene), polytetrafluroethylene (Teflon), casein plastics (Galaith, Ameroid, Galorn), cellulose

acetate (Lumarith, Tenite I, Nixonite), ethyl cellulose (Ethocel), polyvinyl acetals (Butacite, Saflex, Vinylite **X**, Formex, Formel), polyamides (Nylon), styrene copolymers (Styraloy), Polyisobutylene (Polybutene, Vistonex), polyisobutylene-isoprene (Butyl Rubber, GR-I), Cerex, Polyfiber, and Styrofoam.

* * *

CONCLUSION

IN taking leave of this subject, it is well nigh impossible to avoid some reference to predictions that have been made in regard to the place of these synthetic plastics in a world, once again abundant with natural rubber. And in focusing our attention in this direction we must tread circumspectively, for it is a truism that the road of a prophet is fraught with pitfalls. Unquestionably the plastic materials mentioned herein will continue to be used for the reasons already given, to a more or to a less extent; which will prevail is somewhat a matter of conjecture at this time, and of economics.

* * *

NEOPRENE, by example, will persist in use for certain applications where a flexible, fire-resisting, cable is desired. However, there is no denying that rubber compounds for a great number of years served the cable industry well and faithfully. And it is not uncommon for rubber insulated cables to give uninterrupted duty for as long a period as 30 years. Impregnated paper insulated cables, to draw on another example, are proverbial in their reliability in service, having a life at least equal to that of any other electrical apparatus.

* * *

OPPOSED to this experience with the older cable insulating materials is the fact that the synthetic chemist is forging ahead: and, as I have already noted elsewhere, the development of yet untold synthetic materials and the improvement of the present synthetic materials, on atomic principles, is close at hand. But, it would be an extreme stultification on our part to overlook the point that the natural rubber chemist, all the while, has also been studying his product; and, assisted perhaps by the scientific information accrued from the researches of the synthetic chemist and physicist, has no doubt devised improvements in the quality of vulcanized rubber compounds, and increased his knowledge of the structure of natural rubber. Nevertheless there are certain thought provoking indications that may afford some clue to what the future holds in store. And a prudent approach to this question would seem to divulge that, ultimately, the endeavours of the synthetic chemist and the rubber chemist will, in the main converge, somewhere, at some later date, to produce composite insulating materials incorporating the intrinsic advantages of both the synthetic and the natural plastics.

* * *

SOME ACTUAL APPLICATIONS OF THE MORE IMPORTANT SYNTHETIC PLASTICS IN THE CABLE INDUSTRY

Polyethylene Compounds

Application

—R.F. cable insulants both military and domestic
—temporary sheathing on power cables of certain types
—insulant on trans-oceanic and other deep sea communication cables
—extrusion—injection moulding of H.T. components, bushings, R.F. cable connectors, R.F. cable terminations, dipole assemblies
—insulant on medium voltage power cable taps to overhead pole transformers
—insulant on aerial cables used for broadcast relay work and similar networks
—insulant on power cables for direct burial and in duct banks
—insulant on aerial power cables over 5 Kv.

P.V.C. Compounds

—insulant on army field telephone cable
—insulant on various domestic L.V. flexible cords; e.g. lamp cord
—insulant on L.V. control cables, general purpose and in underground ducts
—jacket on R.F. cables for both military and domestic use for installations above ground
—insulant on radio hook-up wire both military and domestic
—insulant and jacket on cables requiring immunity to fungus growths
—insulant and jackets on control cables for military radio equipment
—insulant on commercial and domestic building wires

Neoprene Compounds

—jacket on army and Admiralty power and light cables
—jacket on army field quad telephone cable
—jacket on gun cables where extra resistance to rough usage and exposure to sun encountered
—insulant on aerial L.V. power cables
—jacket on aerial and underground power cables
—jacket on flexible light and power cables for use underground in mines where flame-retarding character of import
—jackets on cables requiring immunity to oils; e.g. some types for Admiralty cables
—jacket on automotive ignition and lighting cables
—jackets on V.C. insulated power cables
—jackets on heavy duty portable cables

Buna S (GR-S) Compounds

—insulant and jackets on aircraft, army and Admiralty cables
—insulant and jackets on L.V. flexible cords for domestic use; e.g. lamp cords, vacuum cleaner cords
—insulant on power and light cables up to 5,000 volts
—insulant on submarine power and control cables
—insulant on anti-aircraft gun control cables
—insulant on radio hook-up wires
—insulant on commercial and domestic building wires
—insulant on power cables require ozone resistant qualities, also those requiring heat resisting qualities
—insulant for high grade automotive ignition cables
—insulant for microphone cables of certain types and other radio cables requiring reasonably low electrostatic capacity properties
—insulant on army field telephone cable
—insulant on army tank cables
—insulant on police and fire-alarm control cables
—insulant and jackets on heavy duty portable cables

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   Julius Veit
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   July 15, 1943

5. Trends in War-Time Insulated Wire & Cables
   S. J. Rosch

(*Please turn to page* 811)

Surplus Electrical Fittings

ALL TYPES FOR IMMEDIATE SALE
at
LOW COST

Electrical fittings of every description are now available to industry, electrical contractors, wholesalers and dealers. Hundreds of items of standard and special equipment are included in this surplus inventory — in many instances the special items are readily adaptable to other uses or needs.

All fittings and equipment are being sold at bargain prices representing a very real saving to purchaser. Prompt delivery is assured.

A partial list of available electrical fittings and equipment is given here:

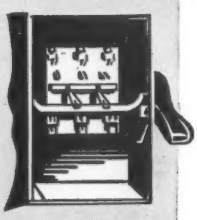
- Condulets
- Switches
- Panelboards
- Connectors
- Special Electrical Motors
- Wiring Devices
- Power Conversion Equipment
- Sub-station Equipment
- Protective Equipment
- Pole-line Hardware
- Plastic Insulating Sheets
- Hundreds of Other Items

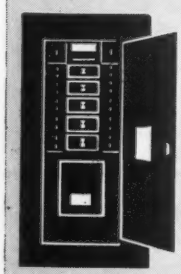
WEATHER RESISTANT CONDULETS

For electrical installations exposed to weather, moisture, steam or combustible dust.

SAFETY SWITCHES

Single and Multiple switches. All ratings and types.



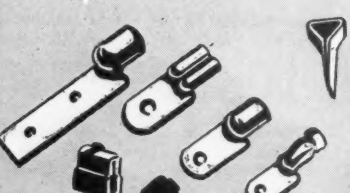


PANEL BOARDS

For lighting and appliance circuits. All electrical services and voltages.

PLASTIC INSULATING SHEETS

Laminated plastic sheets and tubes for electrical uses.



CONNECTORS

Both solder and solderless types.

Send this coupon to your nearest WAA Regional Office:

I AM INTERESTED IN THE FOLLOWING:

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All Electrical Fittings and Equipment are subject to priority regulations. VETERANS OF WORLD WAR II are invited to be certified at the War Assets Administration Certifying Office serving their area and then to purchase the material offered herein.

EXPORTERS:
Most surplus property is available to the export market. Merchandise in short supply is withheld from export, and if such items appear in this advertisement they will be so identified by an asterisk.

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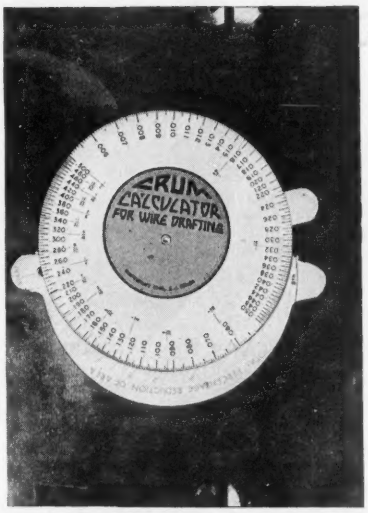
Offices located at: Atlanta • Birmingham • Boston • Charlotte • Chicago • Cincinnati • Cleveland • Dallas • Denver • Detroit • Fort Worth • Helena • Houston • Jacksonville • Kansas City, Mo. • Little Rock • Los Angeles • Louisville • Minneapolis • Nashville • New Orleans • New York • Oklahoma City • Omaha • Philadelphia • Portland, Ore. • Richmond • St. Louis • Salt Lake City • San Antonio • San Francisco • Seattle • Spokane

691-2

The Crum Calculator for Wire Drafting

Provides answers simply and accurately for a given mathematical wire drafting problem. One setting shows number of holes, percentage of draft per hole, total reduction in area and intermediate die sizes to be used. Covers drafting range of .500″ to .005″. Accurate enough for most mill conditions.

* * *



Simple to operate; compact enough to carry in vest pocket; can be used for Metric as well as English systems; all diameters given in decimals. A handy and time-saving device that will eliminate time-wasting and possible errors in calculations.

* * *

EXAMPLES OF PROBLEMS SOLVED QUICKLY BY USE OF THE CALCULATOR

PROBLEM No. 1

DETERMINE the reduction of area in drawing ¼-inch diameter rod to .120 inch wire.

PROBLEM No. 2

SUPPOSE that in Example 1 the tensile strength of the stock is such that the drawing process produces a tensile strength of 100,000 pounds per square inch in the .120 inch wire. To develop the same tensile strength in an .080 inch diameter wire, what stock size is required when the tensile strength of the stock is assumed to be the same as that in Example 1.

PROBLEM No. 3

IN the drafting of .0625 inch diameter wire to .025 inch, no single draft must exceed 21 per cent. Determine the minimum number of holes for this job.

* * *

THE Crum calculator is designed especially for wire drawing jobs involving eight or fewer drafts. Problems involving a greater number of drafts can be solved, however, with extra manipulation. For instance, if it is desired to set up a multi-draft machine to draw .0095 inch diameter wire from .0625 inch stock in sixteen drafts, the intermediate die sizes can be determined by the calculator.

PROBLEM No. 4

A CERTAIN five-block continuous wire drawing machine has a capacity permitting a draft of 33 per cent per hole on low carbon wire. For economic reasons it is desired to find the largest stock size that can be used when finishing .0455 inch diameter wire on this machine.

* * *

PROBLEM No. 5

A continuous machine is to be set up to draw .0375 inch tire bead wire six holes from .122 inch diameter stock. All drafts are to be equal in percentage reduction of area. Determine "a" the intermediate die diameters; "b" the per cent reduction of area per hole; "c" the total per cent reduction of area from start to finish.

PROBLEM No. 6

THE diameter of the finishing block of a double-deck wire drawing machine is twenty-four inches; the diameter of the first block, seventeen inches. The operator wishes to finish .142 inch diameter wire from No. 5 rod and therefore must determine (a) the minimum draft for the finished die, (b) the minimum first die size, (c) and the first die size when a slippage of ten per cent is allowed.

* * *

HOW TO ORDER

The price is $5.00 each. A discount of 10% on ten or more.

Send check or purchase order to

WIRE AND WIRE PRODUCTS

300 MAIN STREET STAMFORD, CONN.

YOU ARE CORDIALLY WELCOMED

to the 1946

WIRE ASSOCIATION CONVENTION

For the 1946 Technical Convention the Wire Industry will foregather in Buffalo, New York at the hotel Statler October 21st — 24th to participate in an exceptionally fine series of technical sessions and to re-appraise the problems of production in the light of the new conditions that peace imposes on our industry.

Besides the technical sessions, ample opportunity is afforded to members to meet with others and exchange ideas on many technical and practical questions that do not lend themselves to discussion in meetings. These exchanges of views between wire men and between them and equipment and material suppliers have often led to the development of new equipment and processes in such manner as to bring about notable advances in production techniques.

It is sincerely hoped that as many as possible of the wire industry, producers and suppliers, will take this occasion to attend and profit by the facilities of the Convention to further the interests of the industry in getting off to post-war production on the right foot. Your attendance at and participation in the affairs of the Convention will help to lay a firm foundation for a sound future for our industry.

Remember the time, the place and the date, and

BE THERE!

THE WIRE ASSOCIATION

RICHARD E. BROWN, Executive Secretary

300 MAIN STREET STAMFORD, CONN.

SURPLUS unused *Tubing*

FOR IMMEDIATE SALE

Standard and Non-Standard O. D.'s and Wall Thicknesses
Range of Sizes from ¼" to 7"

Types: Carbon, Alloy, and Some Stainless; Both Welded and Seamless.

Price: ALL TO BE SOLD ON FIXED PRICE BASIS, F.O.B. LOCATION.

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157-7

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THE Wire Association is a non-profit organization of wire mill executives, superintendents and foremen. It also includes plant engineers, traffic men, and all others engaged in the production of cold drawn bars, rods, wire, strip, insulated wire and cable, and the manufacture and fabrication of finished wire products, including cold headed, extruded and other cold worked metal products.

THERE are separate divisions for all the separate major interests in the wire industry, steel, iron, brass, copper, alloy, and precious metals, together with divisions relating to drawing, cold working cold heading, extruding, fabricating, forming, spring making, wire cloth, wire rope, bare and covered electric wire and cable and all other forms of wire and wire products.

* * *

PURPOSES

ITS specific purpose is to improve production methods and afford a clearing house for ideas on management problems, technical problems, and research work in all phases of practical wire drawing and wire working, and to develop and maintain friendly relations among the members.

* * *

ACTIVITIES:

The Association functions along the following lines:

1. The use of the Association headquarters as a central clearing house for information and data of all kinds which may be of interest to members.
2. The exchange of ideas on processes of production including machinery, technical processes, etc.
3. The establishment and maintenance of friendly relations among the members of the association and the development of sectional and national meetings to discuss matters of mutual interest.
4. Studies of production methods and analysis of production costs.
5. Developments in the use of new materials and new applications of existing materials and by-products.
6. Research and collection of information on personnel management, including such factors as labor turnover, seasonal changes in the demand for employees, wage scales, etc.
7. Standardization and simplification as a means for the effective elimination of waste.
8. Such other subjects as may be determined upon.

PROGRAM

Wire Association Technical Convention

Buffalo, N. Y., October 21-24, 1946 — **Association Headquarters—Hotel Statler**

Wire Association Headquarters at The Statler Hotel
Will Be Open from Monday, October 21, All Day and Every Evening During the Convention
—Come and Get Acquainted!

THERE WILL BE A REGISTRATION FEE OF $5.00 FOR THOSE ATTENDING THESE TECHNICAL SESSIONS AND INFORMAL MEETINGS

* * * ADMISSION WILL BE BY BADGE ONLY * * *

Open Discussions Will Be Held on the Papers Presented and These Discussions Will Be Published in the January, 1947, Issue of Wire and Wire Products

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Hotel reservations should be made by members of the Wire Association direct to the Secretary
MAKE YOUR PLANS NOW TO ATTEND AND SEND YOUR RESERVATION IN PROMPTLY

MONDAY, OCTOBER 21

10:30 A. M.
DIRECTORS' MEETING

12:30 P. M.
PROGRAM COMMITTEE LUNCH

Registration and Information at The Hotel Statler—October 21-24—in charge of
Mrs. R. S. Spengel, Secy.-Treas., WIRE & WIRE PRODUCTS

TORRINGTON

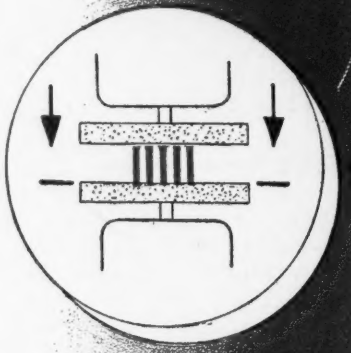
FEATURES A REVOLUTIONARY NEW SPRING

MULTIPLE PASS GRINDING SETS NEW PRODUCTION RECORDS FOR ACCURACY, FINISH AND SPEED

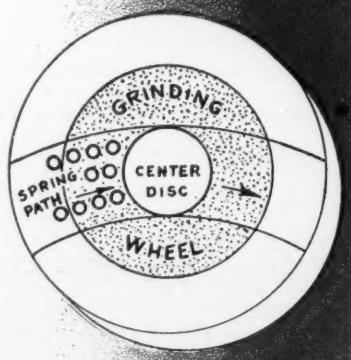
MULTIPLE pass grinding, an exclusive feature of Torrington's new Spring Grinder, makes it possible to grind springs to tolerances never before obtainable, and to do so at far higher production speeds than with any other facilities.

This new, patented grinder gently removes a few thousandths from both ends of the springs simultaneously, at each revolution. When the desired dimension is reached, it "sparks out" to a precision finish. The ground surfaces are at true right angles to the axis of the spring. Multiple pass grinding produces no burning, no burring, no deformation of the spring.

ONE pass grinding can also be done by Torrington's Spring Grinder, by use of the lower speed range of the work carrier wheel. The two ranges may also be combined, utilizing rapid traverse of the unused portion of the wheel for small, single pass runs. Production by the single pass method is at least equal to, and in most cases, higher than is possible with any other machine.



Positively controlled Hydraulic infeed (upper wheel only), entirely independent of spring compression. Dial controls variable rate of approach between .010" and .100" per minute. Rate and amount of feed, or any change in distance between grinding wheels, visible on indicator graduated in thousandths.



Uniform grind on every spring. Arcuate spring path across center of grinding wheel not only results in same treatment for every spring, but causes wheel to wear evenly—prevents coning. Center disc of softer abrasive to compensate for slower surface speed. No abrasive is wasted; wheel dressing is practically eliminated.

SPECIFICATIONS

Spring Capacity: **Lengths ¼" to 16"; diameters ¼" to 7"; wire diameters .040" to .375".**

Grinding Wheels: **Diameter 24"; maximum usable abrasive 2".**

Grinding Feed: **.010" to .100" per minute.**

Work Carrier Wheel Speeds: **4 to 16 revolutions per hour, or 1.1 to 4.5 revolutions per minute.**

Available Work Carrying Area: **(including spring holders) approximately 850 sq. in.**

Work Carrier Wheel Diameter: **54"; width of grinding path 8½".**

Floor Space Required: **54" x 100"; maximum overall height 116".**

Weight: **14,000 lbs.**

NEW SPRING GRINDER

GRINDING METHOD

Patent No. 2,375,333

SPECIAL FEATURES

- **LOAD INDICATOR** shows electrical load on each grinding wheel motor. Any excess load is instantly visible.
- **TILTING MECHANISM** permits quick manual changeover of grinding wheels, in or out of parallel as desired for single or multiple pass grinding. Degree of tilt shown by pointer and scale.
- **GRINDING WHEEL MOVEMENT** manually or by motor, either wheel independently or both in unison, except that lower wheel remains stationary when grinding.
- **DUST EXHAUST** through customer's system, or dust collector unit may be furnished. Either attaches to built-in duct from grinding wheels to exterior of grinder.
- **OBSERVATION WINDOW,** glass covered, with steel protector slide, for ready inspection of grinding action.
- **STEEL WEAR PLATE** on work carrier wheel table is abrasive-resistant, but is also easily replaceable.
- **GRINDING WHEELS** easily removable, by dismounting wheel plates.

The TORRINGTON

MANUFACTURING COMPANY, TORRINGTON, CONN., U. S. A.
Designers and Builders of Metal-Working Machinery Since 1885

—The Technical Sessions—

RESEARCH PAPERS ARE PREPRINTED IN THE OCTOBER ISSUE OF WIRE AND WIRE PRODUCTS

The Discussions and the Mordica Memorial Lecture Will be Printed in the January, 1947 Issue of Wire and Wire Products

MONDAY, OCTOBER 21 Afternoon Session — 2:00 P. M.	John A. Moritz, Superintendent Wire Mills, Chairman of Meeting	Keystone Steel & Wire Co., Peoria, Ill.
OPENING ADDRESS	Rowland M. Hussey,	President of the Wire Association
LECTURE: Present Day Labor Problems	by John L. Sanderson, Asst. Supt. Wire Mills	Keystone Steel & Wire Co., Peoria, Ill.
PAPER: Demineralized Water in the Wire Mill	by Dr. F. R. Morral, Metallurgist	American Cyanamid Company, Stamford, Conn.
TUESDAY, OCTOBER 22 Morning Session — 10:00 A. M.	L. Atkinson, Works Manager Chairman of Meeting	Frost Steel & Wire Co., Ltd., Hamilton, Canada
PAPER: The Manufacture of Steel for Basic Rope Wire	by Ralph D. Hindson	The Steel Co., of Canada, Ltd. Hamilton, Canada
PAPER: Some Unusual Conditions Encountered in Cold Heading Products	by F. W. Nobbs, Chief Inspector	The Steel Co. of Canada, Ltd., Toronto, Canada
TUESDAY, OCTOBER 22 Afternoon Session — 1:30 P. M.	A. E. Glen, Manager of Die Sales Chairman of Meeting	Carboloy Company, Inc., Detroit, Mich.
PAPER: The Application of the Cyclograph to the Non-Destructive Inspection of Materials; in Particular, Wire Rope	by Dr. O. W. Ellis, Director Dept. of Engineering and Metallurgy,	Ontario Research Foundation, Toronto, Canada
PAPER: Mill Practice — The Care and Maintenance of Dies	by R. R. Preston, Engineer	The Carboloy Co., Inc., Pittsburgh, Pa.
Motion Picture — "Everyday Miracles"		
WEDNESDAY, OCTOBER 23 Morning Session — 10:00 A. M.	John G. Fraser, General Manager Chairman of Meeting	The Northern Bolt, Screw & Wire Co., Ltd. Owen Sound Ontario, Canada
PAPER: Preparation of Metallographic Specimens	by Freeman G. Anderson, Chief Metallurgist and R. E. McGraw	National Lock Co., Rockford, Ill.
PAPER: Applications of Tin as a Coating Material	by Dr. Bruce W. Gonser	Battelle Memorial Institute Columbus, Ohio

The following papers were not received in time for preprinting. They will be published in the November and December issues of Wire and Wire Products:

"Applications of Tin as a Coating Material"

"Applications of Fiberglas to Wire and Cable"

"Mill Practice — The Care and Maintenance of Dies"

"Preparation of Metallographic Specimens"

"Some Observations on Manufacturing Insulated Wire in Wartime Germany and the United States"

"Synthetics for Wire and Cable"

WEDNESDAY, OCTOBER 23

1:00 P. M.

WIRE ASSOCIATION LUNCHEON — HOTEL STATLER

WIRE ASSOCIATION MEDAL AWARD

THE MORDICA MEMORIAL LECTURE

"Galvanized Steel Wire"

To Be Presented By

Fred M. Crapo, President,
Indiana Steel & Wire Company
Muncie, Ind.

(Members are at liberty to bring guests. Ladies are welcome)

WEDNESDAY, OCTOBER 23

4:30 P. M.

Wire Association Annual Meeting

Rowland M. Hussey,
President, The Wire Association

CHAIRMAN OF MEETING

WEDNESDAY, OCTOBER 23

ANNUAL DINNER — STAG SMOKER — HOTEL STATLER

Evening — 7:00 P. M.

A. R. ZAPP,
Manager, Carbide Division

CHAIRMAN OF COMMITTEE

Firth-Sterling Steel Company
McKeesport, Pa.

THURSDAY, OCTOBER 24

	George A. Fowles, Manager	The B. F. Goodrich Co. Cleveland, Ohio
Morning Session — 10:00 A. M.	Wire & Cable Material, Chemical Div. Chairman of Meeting	
PAPER: Aluminum Wire Fabrication	by H. S. Spaulding	Aluminum Company of America
	This paper will be presented by W. E. King Chief Metallurgist	Massena Works, Aluminum Company of America
PAPER: Some Observations on Manufacturing Insulated Wire in Wartime Germany and The United States	by R. A. Schatzel, Vice President and Director of Engineering	Rome Cable Corporation Rome, N. Y.

THURSDAY, OCTOBER 24

Afternoon Session — 1:30 P. M.	H. B. Carnahan, Asst. Works Mgr., Chairman of Meeting	Canada Wire & Cable Co., Ltd., Toronto, Canada
PAPER: Synthetic Insulants in the Cable Industry	by D. Short, Electrical Engineer	Canada Wire & Cable Co., Ltd., Toronto, Canada
PAPER: Applications of Fiberglas to Wire and Cable	by Fred F. Sampson, Jr., In Charge of Wire and Cable Section, Insulated Wire Division	Owens-Corning Fiberglas Corp., Toledo, Ohio
PAPER: Synthetics for Wire and Cable	by H. B. Slade Electrical Research Engineer	The Okonite Company Passaic, N. J.
Motion Picture — Noranda Enterprises		

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THE WIRE ASSOCIATION MEDAL AWARDS

For the Most Meritorious Paper on Wire Manufacture or Fabrication During the Year
— BY A MEMBER OF THE WIRE ASSOCIATION —

ALL members of the Wire Assocation are cordially invited to submit technical papers either for publication in "WIRE & WIRE PRODUCTS" during the year or for presentation before the Annual Wire Association Convention.

★ ★ ★

AN annual medal will be awarded in each of the two major divisions of the activities of the Association, to the papers coming nearest to the requirement set forth above.

★ ★ ★

CONSIDERATION for the Medal Awards is not limited to the papers presented at the Annual Meeting, but is given to all papers submitted by members and published in "WIRE & WIRE PRODUCTS" during the year.

★ ★ ★

ALL papers submitted become the property of the Wire Association and the Board of Directors constitutes the Committee on Awards.

★ ★ ★

SELECTION of papers to be presented at the Annual Convention rests in the hands of the Joint Program Committee and the Board of Directors of the Wire Association.

MEDAL AWARDS

1934 — EDWARD J. P. FISHER
Metallurgist, Keystone Steel & Wire Co., Peoria, Ill.
Title of Paper: "COLD DRAWN STEEL SPRING WIRE"

1935 — BENJAMIN LEWIS McCARTHY
Metallurgist, Wickwire Spencer Steel Co., Buffalo, N. Y.
Title of Paper: "GRAIN SIZE AND ITS INFLUENCE ON THE MANUFACTURE OF STEEL WIRE"

1936 — ROBERT NOTVEST
Chief Engineer, Welding Division, J. D. Adams Mfg. Co., Indianapolis, Indiana
Title of Paper: "STEEL FOR ARC WELDING ELECTRODES"

1937 — BENJAMIN LEWIS McCARTHY
Chief Metallurgist, Wickwire Spencer Steel Co., Buffalo, N. Y.
Title of Paper:
"ABNORMAL GRAIN GROWTH AND THE ANNEALING OF LOW CARBON STEEL WIRE"

1938 — WALTER R. BLOXDORF
Metallurgist, The MacWhyte Co., Kenosha, Wis.
Title of Paper: "WIRE ROPE"

1939 — STANLEY P. WATKINS
Manager, Sales Development, Rustless Iron and Steel Corp., Baltimore, Maryland
Title of Paper:
"THE MANUFACTURE AND USE OF STAINLESS STEEL WIRE"

1940 — ROBERT W. SANDELIN
Metallurgist, Atlantic Steel Company, Atlanta, Georgia
Title of Paper:
"GALVANIZING CHARACTERISTICS OF DIFFERENT TYPES OF STEEL"

1941 — CARLETON W. GARRETT
Wire Mill Metallurgist, Jones & Laughlin Steel Corp., Aliquippa, Pennsylvania
Title of Paper:
"A BRIEF DISCUSSION ON THE MANUFACTURE OF STEEL FOR ARC WELDING ELECTRODES"

1942 — LEROY DEVOE SEYMOUR
Asst. Works Manager, Canada Works, Steel Company of Canada, Ltd., Hamilton, Ontario, Canada
Title of Paper:
"SCHEDULING AND PLANNING THE WIRE MILL FOR WAR PRODUCTION"

1943 — JOHN C. AIKEN
Asst. Supt., Rod and Wire Mills, Jones & Laughlin Steel Corp. Aliquippa, Pa.
Title of Paper: "DRAWING HIGH SPEED ROPE WIRE"

1944 — AUGUST R. ZAPP
Manager, Carbide Division, Firth-Sterling Steel Company, McKeesport, Pa.
Title of Paper:
"HISTORY AND GROWTH OF THE TUNGSTEN CARBIDE DIE"

HONORABLE MENTIONS

1935 — L. D. SEYMOUR
Metallurgist, Rod and Wire Dept., Youngstown Sheet & Tube Co., Youngstown, Ohio
Title of Paper: "COLD HEADING WIRE"

1935 — R. A. SCHATZEL
Superintendent, General Research Laboratories, General Cable Corp., Rome, N. Y.
Title of Paper: "HARD AND SOFT COPPER WIRE"

1936 — BENJAMIN LEWIS McCARTHY
Metallurgist, Wickwire Spencer Steel Co., Buffalo, N. Y.
Title of Paper:
"PLASTIC DEFORMATION IN WIRE DRAWING"

1937 — ROBERT W. SANDELIN
Metallurgist, Atlantic Steel Co., Atlanta, Ga.
Title of Paper:
"A METALLURGICAL STUDY OF THE FACTORS AFFECTING THE QUALITY OF GALVANIZING"

1937 — ALLAN B. DOVE
Chemical Engineer, Canada Works, The Steel Company of Canada, Ltd., Hamilton, Ont., Canada
Title of Paper:
"A. C. ELECTRO PICKLING—A BETTER METHOD OF PICKLING"

1938 — RODMAN R. TATNALL
Metallurgist, Morgan Works, Wickwire Spencer Steel Co., Worcester, Massachusetts
Title of Paper: "RESILIENCE OF SPRINGS"

1938 — JOSEPH A. DOYLE
Vice President, W. S. Rockwell Co., New York, N. Y.
Title of Paper: "HEATING COPPER WIRE BARS"

1940 — H. BLOUNT and J. D. WILTRAKIS
Mfg. Engineer, Point Breeze Works, Engineer, Kearny Works, Western Electric Company
Title of Paper:
"DESIGN AND OPERATION OF A NEW COPPER WIRE DRAWING PLANT"

1941 — RODMAN R. TATNALL
Metallurgist, Morgan Works, Wickwire Spencer Steel Co., Worcester, Massachusetts
Title of Paper:
"TIME, TEMPERATURE AND SIZE IN THE HEATING OF STEEL WIRE"

1942 — COLONEL FRANK W. BULLOCK
Signal Corps, United States Army
Title of Paper: "THE WIRE INDUSTRY IN WAR"

1943 — E. J. CRUM
General Foreman, Bethanizing and Galvanizing Departments, Bethlehem Steel Company, Sparrows Point, Md.
Title of Paper:
"THE GRAPHICAL SOLUTION OF WIRE MILL MATHEMATICAL PROBLEMS"

1944 — FERNALD S. STICKNEY
Vice President and Chief Engineer, Instrument Specialties Company, Little Falls, N. Y.
Title of Paper:
"MAKING 'SPRING-GRADE' BERYLLIUM COPPER WIRE"

Some Theoretical and Practical Concepts of Synthetic Insulants in the Cable Industry

(*Continued from page* 799)

A paper presented at the 16th Annual Engineering Conference Missouri Valley Electric Association, Kansas City, Mo., April 6 & 7, 1944

6. **Polymer Buna S Supplies Major Demand of Electrical Conductor Producer**
   O. W. Titus
   Electrical News & Engineering
   Vol. 53—1944

7. **Synthetic Rubbers in the Wire & Cable Industry**
   R. A. Schatzel
   Symposium on the Applications of Synthetic Rubbers published by the A.S.T.M., 1944

8. **Thermoplastic Cables**
   Barron, Dean, Scott,
   J.I.E.E.
   Vol. 91, No. 22, p. 297
   Part II, August, 1944

9. **Copolymer Vinyl Resins**
   J. D. Beneditto
   Abstracted in Chemical Trade Journal, 112, p. 359, 1943

10. **High Frequency Heating For Plastics**
    Anonymous
    British Plastics
    Vol. 15, p. 322, 1943

11. **Synthetic Rubbers & Plastics, I**
    W. C. Barry
    Distribution of Electricity
    Vol. 15, p. 70, 1943

12. **Synthetic Rubbers & Plastics, II**
    H. A. Tunstall
    ibid, p. 93

13. **Synthetic Rubbers & Plastics, III**
    Pollett, Jesson
    ibid, p. 142 & 172

14. **Contributions of the Chemist to Insulation Research**
    January, 1943 — January, 1944
    The Committee on Chemistry Conference on Electrical Insulation National Research Council, Washington, U.S.A.

15. **Developments in Insulating Materials**
    J. F. Gillies
    J.I.E.E.
    Vol. 86, No. 517, p. 66
    January, 1940

16. **Chemical Background for Electrical Properties of Plastics**
    H. M. Richardson
    Electrical World
    Vol. ...., No. ...., p. 67, April 17 ,1943

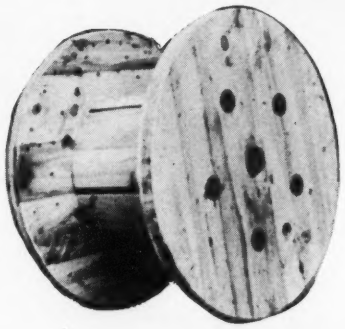
17. **Trees & Test Tubes**
    C. M. Wilson
    Henry Holt & Company, 1943

18. **Transmission Section: Chairman's Address**
    S. W. Melsom
    J.I.E.E.
    Vol. 89, No. 13, p. 56
    Part I, January, 1942

19. **Polythene**
    J. C. Swallow
    Endeavour
    Vol. III, No. 9, p. 26
    January, 1944

(*Please turn to page* 817)

REELS



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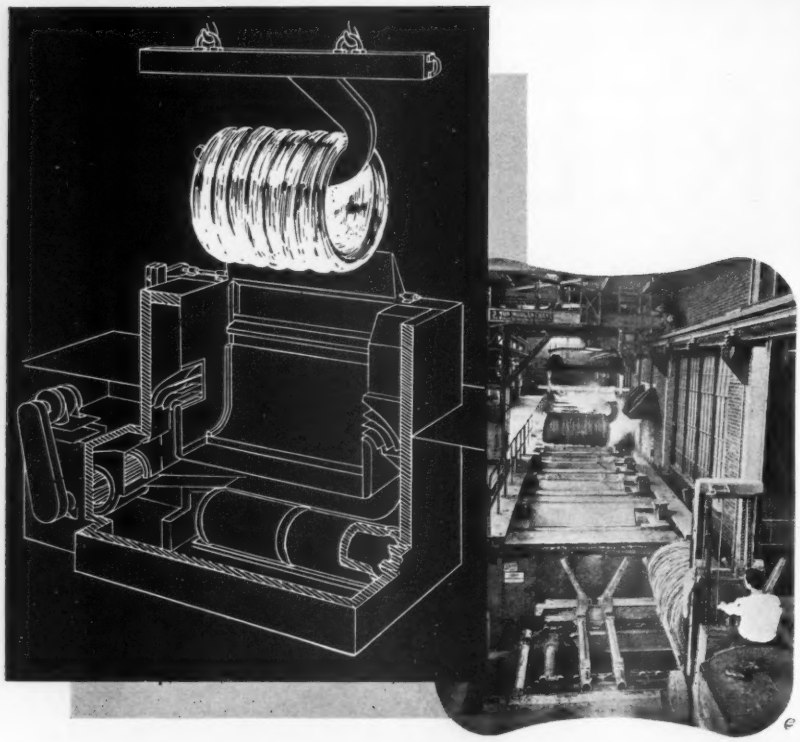

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Morrison wire mill experience is available for designing faster and more effective baking, coating, impregnating and drying equipment. Recommendations made by Morrison have been gratifying to scores of wire fabricators... Call Cleveland HEnderson 6666.

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Casting of Rolling and Extrusion Stock

SEMI-CONTINUOUS casting of rolling and extrusion stock was highly developed by the German light metal industry during the war, according to a 31-page report now on sale by the Office of Technical Services, Department of Commerce. Another major development in the German industry was the use of electrical resistance furnaces in combination with induction melting.

* * *

THIS report on German technique in the production of light alloys was prepared by Dr. P. M. Haenni of the Canadian Military Headquarters and T. J. Peake, Superintendent of Technical Applications of Metals, Ministry of Supply, for the British Intelligence Objectives Sub-Committee.

* * *

THE most commonly used semi-continuous casting method was the "Wasserguss" (water spray) system, developed by the Vereinigte Leichtmetallwerke, in Hanover. A water-jacketed aluminum or copper mould, with a movable bottom mounted on a hydraulic ram, was used to make metal bars. As the metal solidified, the ram moved downward and the bar emerged from the mould. The bars were cooled by water running through the water jacket and then passing through holes or slits in the bottom of the mould. Further cooling was obtained by passing the bar into a tank containing circulating water.

* * *

ANOTHER type of water-jacketed mould, with a movable wall, was used for semi-continuous casting of narrower ingots. The moveable wall was raised gradually as the liquid metal was poured into the mould.

* * *

IN most aluminum alloy producing plants in Germany, melting was done in induction furnaces with an inclined hearth, permitting the metal to run down to the cooler part of the furnace as it melted. Metal was transferred from the melting to the holding furnaces by gravity or suction. The holding furnaces usually were of the electric

resistance tilting type.

* * *

OTHER major developments in the German light metal industry were the rolling of tapered section sheet for aircraft and electrolytic refining for scrap recovery.

* * *

THE Germans lagged behind the Allies in the use of high-strength, artificially aged aluminum alloys for aircraft; in brazing of aluminum alloys; rolling of propeller blades; and in the use of high-purity, heat-treated aluminum casting alloys, according to the investigators.

* * *

THE report covers German processes for reducing aluminum, casting ingots, manufacturing aluminum and magnesium alloy castings for engine components, and for producing alloy sheet, extrusions, tubes, and forgings.

* * *

Gage for Thin Coatings on Steel

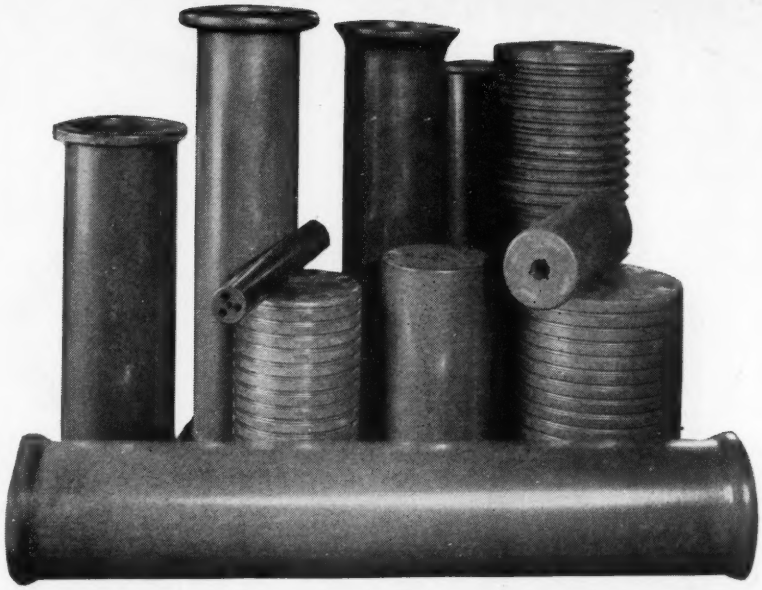
A magnetic gage for measuring the thickness of thin coatings on steel, developed at Frankford Arsenal, Philadelphia, during the war, is described in a report now on sale by the Office of Technical Services, Department of Commerce. The new method was said to be simpler, cheaper, and more rapid than other magnetic measuring devices in use in 1944, when the report was written.

* * *

ESSENTIALLY, the device consists of a solenoid containing a soft, movable iron core and is equipped with a suitable indicator scale. An alternating current is used to energize the solenoid.

* * *

IN operation the solenoid is placed over the steel coating so that its iron core is magnetically attracted to the coating. The core is then lifted to a "critical" position, at which the attraction of the solenoid for the core will just overcome that of the steel. The "critical" position varies with the thickness of the coating. The operator takes a reading from the indicator scale at this point.



Corrosion-Proof Rolls and Processing Tanks

Knight-Ware corrosion-proof wire and sheet rolls or sinkers are made to meet customers' needs. You can choose the diameter, groove spacing and length to fit your operation. They are entirely acid-proof and hard with no coating or shell to depend on for acid resistance or wear.

Pickling and plating tanks which are acid-, alkali- and leak-proof are available of Pyroflex Construction. These are steel tanks lined with suitable corrosion-proof materials to best meet your particular operating conditions.

Knight engineers welcome your inquiries on wire rolls and Pyroflex processing tanks. Be sure to give them as complete data as possible regarding the character and purpose for which this equipment is to be used.

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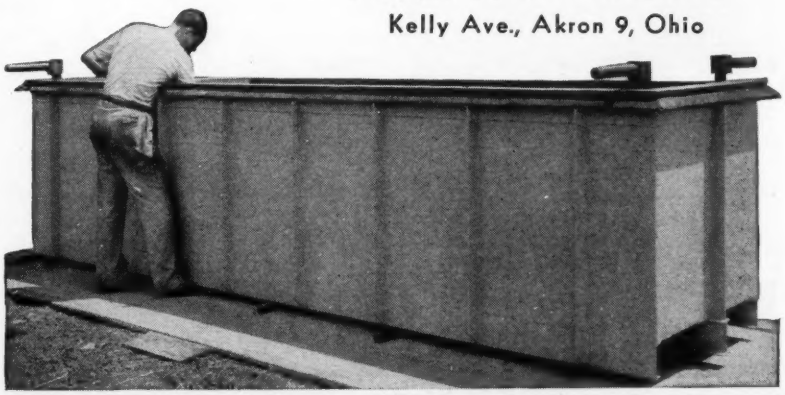
Kelly Ave., Akron 9, Ohio



Typical Knight Pickling Tank of Pyroflex Construction

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"Toys that Mold Character"

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Sturdy . . . well built . . . they withstand the hard usage expected from "mother's little helper."

The wire handles, wheel pins and other points required to withstand strain are all made of Keystone wire.

No matter what the specifications, Keystone wire can normally supply it.

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KEYSTONE
MUSIC SPRING WIRE
KEYSTONE STEEL & WIRE CO.
PEORIA, ILLINOIS

SPECIAL ANALYSIS WIRE
for all industrial purposes

KEYSTONE STEEL & WIRE CO., Peoria 7, Ill.

VOLTAGE variations within reasonable limits did not affect the accuracy of the instrument. The maximum error of the device ranged from plus or minus five per cent for films 0.002 inches thick, to plus or minus three per cent for thicker coatings.

* * *

THE characteristics of the instrument and its method of operation are fully described in the report. Performance data in graphic form are included.

Aluminum Clothesline

THE new **Nichols** Aluminum Clothesline offers several advantages as a permanent clothesline for installing in drying yards, attics or basement laundry rooms. It is smooth surfaced — not stranded — can't snag or catch in delicate fabrics; is uniform gauge (.148") to fit all clothes pins. It is durable and non-rusting. Wipping with cloth makes it bright and clean.

* * *

THIS Aluminum Clothesline is available for immediate delivery in 300-foot coils, marked with red tape every 50-foot length for convenience in selling.

* * *

WRITE **Nichols Wire & Steel Co.,** Davenport, Iowa, for complete information and prices.

Wheeling Steel Corporation Planning to Expand

IN a program of modernization and expansion, the **Wheeling Steel Corporation** has made plans calling for an expenditure of $500,000,000 or more.

* * *

THE program will take several years to complete and will involve most of its divisions, especially its newly acquired plant at Mingo, Ohio, recently bought from the Carnegie-Illinois Steel Corporation.

* * *

WHEN completed, not including the tonnage formerly made at Portsmouth, their ingot capacity is expected to be increased annually by 2,000,000 tons.

New Communications Wire Developed by Signal Corps

A new light-weight, flexible communications wire —developed by the **Signal Corps Engineering Laboratories**— has been standardized for general field use by the Army, the War Department announced recently.

* * *

COMMONLY called "Infantry Wire," the new type represents a successful effort to combine the substantial talking range and other characteristics of field wire —the general, all purpose communication wire of which 4,000,000 miles were procured during the war — with the small size and portability of assault wire, of which a million miles were used by fast-moving units.

* * *

ALTHOUGH the final characteristics and tactical employment will be determined by further development by the Signal Corps and by extensive field use, Infantry wire is recognized as a complete replacement for assault wire and a partial replacement for field wire.

* * *

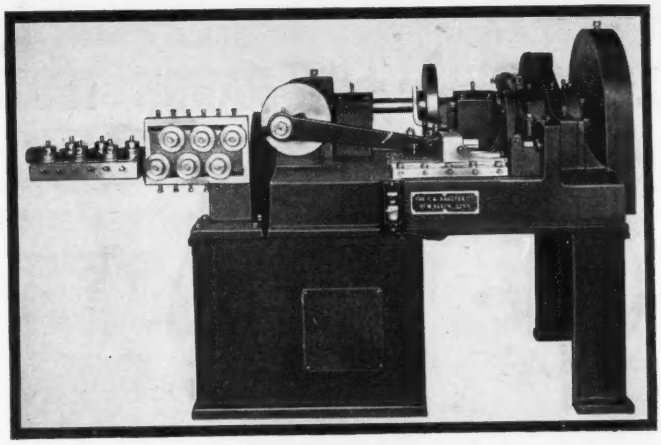
SIGNAL Corps engineers point out that, in general, it is a tenet of wire design that as a wire is made smaller its electrical losses increase and the talking range decreases. Scientific efforts expended during World War II, however, revealed new materials and methods of use which overcame many of the previous difficulties and indicated the solution of the problem.

* * *

INFANTRY wire (WD-1/TT in Signal Corps nomenclature) provides a talking range equal to that of field wire yet its weight is only about 46 pounds per mile, about one-third that of field wire. Its diameter is .084 inches, about one-half that of field wire.

* * *

IT is composed of two conductors, each individually insulated and jacketed, and twisted together to form a light-flexible, flat lying "twisted pair." Each conductor is composed of three zinc-Coated high-Carbon steel strands and four tinned copper strands, all twisted together in a tight, concentric



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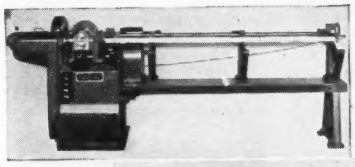
These machines straighten and cut round, hex, square and various other shaped stock from coils — and are especially recommended where accuracy and a square cut are very essential. The machine shown above has 3/8" capacity with 7½" maximum length of cut. Other sizes are also available. When writing for information, please give shape, size and kind of material to be straightened and the maximum length of cut required.

OTHER SHUSTER WIRE STRAIGHTENING MACHINES



Type 1A
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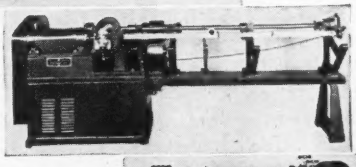
Dia.



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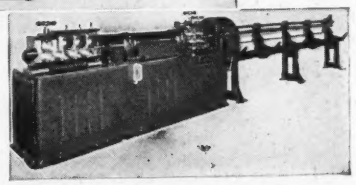

Type 3A
3/16" - 3/8" Dia.

Type 4A (not shown)
3/8" - 5/8" Dia.

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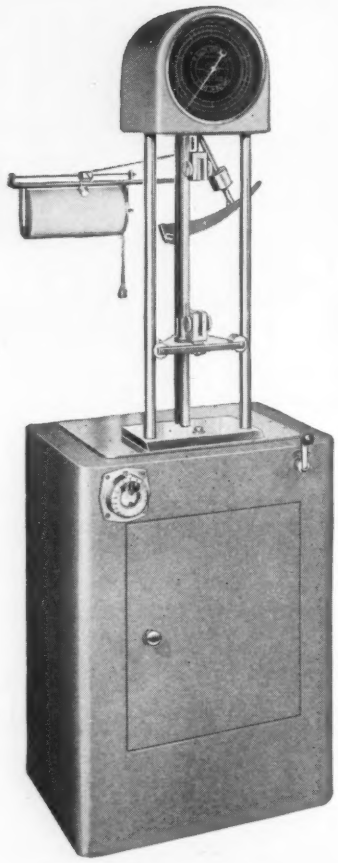
SHUSTER SINCE 1866

Automatic WIRE STRAIGHTENING AND CUTTING MACHINES

DILLON MULTI-LOW-RANGE TESTER



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bundle. A tight fitting cylinder of polyethylene, a new, low loss electrical insulation, is extruded over these metallic strands. Then a thin covering of nylon is extruded and pulled down tight over the polyethylene insulation so as to provide a tight waterproof container for the insulation.

* * *

THE Signal Corps' field wire (W-110-B) will still be used in considerable quantities because of its proven value and special characteristics. During the war this all-purpose wire, which proved the nerve center of tactical communications was consumed in such staggering quantities during the sweep through France and Germany that all available facilities of the wire and cable industry in the United States could barely keep pace with the demand. A peak production of 180,000 miles a month was reached at the time of Germany's surrender.

* * *

FIELD wire was hung from telephone poles, spanned from tree to tree, laid along roads, in ditches, and across country, thrown into shrubbery near roads or buried when feasible. It was supplied in half and one mile lengths on metal reels and was dispensed from a moving vehicle or from a hand carried dispenser. It was designed for voice-frequency communication between telephone, telegraph sets, teletypewriters, facsimile sets and associated switchboards, but due to its availability, flexibility and tensile strength, it was used for other emergency purposes, ranging from radio antenna feeders to tow ropes.

* * *

DURING the war the Signal Corps laboratories also developed a special coil and dispenser by which assault wire could be laid from aircraft and moving vehicles or shot from bazookas or rifle grenades.

* * *

THE laying of wire by airplane over mountain peaks, deep valleys and dense forests greatly simplified the operations of communications troops.

Some Theoretical and Practical Concepts of Synthetic Insulants in the Cable Industry

(*Continued from page* 811)

20. **Plastics — A Brief Review of Their Physical and Electrical Characteristics**
    A. J. Warner
    Electrical Communication
    Vol. 22, No. 1, p. 70, 1944

21. **Advances in the Scientific Knowledge of Rubber**
    E. H. Farmer
    Endeavour,
    Vol. III, No. 10, p. 72, April, 1944

22. **Synthetic Rubber & Plastics — IX (Mechanical Properties in Relation to Molecular Structure)**
    W. F. O. Pollett, B.Sc.,
    Distribution of Electricity
    Vol. XVIII, No. 160, p. 48

23. **Some Notes on the Structure of the Atom**
    E. E. Woods, B.Sc.,
    ibid, p. 60

24. **The Dielectric Properties of Cellulose Acetate**
    Hartshorn, Rushton
    J.I.E.E.
    Vol. 83, No. 501
    September, 1938

25. **The Control, Specialized Testing and Use of Some Modern Insulating Materials**
    J.I.E.E.
    Vol. 90, No. 35, p. 463
    Part I, November, 1943

26. **The Possible Application of New and Accelerated Technique to Peace-Time Problems**
    G. H. Fletcher
    J.I.E.E.
    Vol. 91, No. 39, p. 126
    Part I, March, 1944

27. **An Elementary Description of Some Molecular Concepts of the Structure of Dielectrics**
    E. B. Moullin, M.A., Sc.D.
    J.I.E.E.
    Vol. 91, No. 48, p. 448
    Part I

28. **Theory of Dielectric Constant and Energy Loss in Liquids and Solids**
    H. Frolich
    ibid, p. 456

29. **The Story of Electricity**
    John Munro
    Hodder & Stoughton
    Publishers, London
    undated

30. **The Development of Polyethylene as a High Frequency Dielectric**
    Prof. Willis Jackson, D.Sc., D.Phil., J.S.A. Forsyth, B.Sc.,
    J.I.E.E.
    Vol. 92, No. 17, p. 23
    Part III, March, 1945

31. **Contributions of the Chemist to Insulation Research**
    January, 1944 — January, 1945
    The Committee on Chemistry
    Conference on Electrical Insulation
    National Research Council
    Washington, U.S.A.

32. **Wiring Insulation for Tropics**
    W. J. Tucker, J. V. Wredden
    Plastics (London), p. 284, 1945

33. **Notes on Plastics — Polystyrene**
    James Taylor, B.Sc.,
    The Electrician
    Vol. CXXXV, No. ...., p. 541
    November 16, 1945

34. **Plastic Notes**
    James Taylor, B.Sc.,
    The Electrician
    Vol. CXXXV, No. 3518, p. 473
    November 2, 1943

35. **Some New Features of Low-Voltage Cable**
    L. D. Madsen, R. B. McKinley
    General Electric Review
    Vol. 48, No. 10, p. 44
    October, 1945

36. **Plastic Chemistry in the Electrical Field**
    W. C. Goggin, R. F. Boyer
    Electrical World
    Vol. ...., No. ...., p. 100
    December 9, 1944

37. **The Polarization of Dielectrics in a Steady Field of Force**
    W. M. Thornton, O.B.E., D.Sc., D.Eng.
    Philosophical Magazine
    Vol. 19, p. 390, 1910

(*Please turn to page* 819)

"Standard"
UNI-DRIVE
Wire Winder

INCREASE YOUR PRODUCTION — The UNI-DRIVE Wire Winder shown above is typical of the many models which can be supplied to meet your specific operating requirements; winding braider bobbins, spooling wire, plastics, solder, etc. — Ideal for winding sales packages. The new micrometer variable traverse motion and geared-wind produce a straight, parallel wind which eliminates jumping of the guide on the braider latch.

- Slow Start
- Winds evenly between heads of spools
- Winds up to 12 ends on each spool
- Eliminates main drive belts
- Easily adjusted traverse motion from ½" to 6" between heads without changing the cam
- Complete with single phase ¼ H.P. motor, 110 volt, 60 cycle, A.C.

STANDARD MILL SUPPLY CO.

General Office PAWTUCKET, R. I.
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STANDARD MILL SUPPLY CO. OUR 50th YEAR PAWTUCKET, R.I. 1896 1946

Write to nearest office for complete information.

500 RATHBONE AVE AURORA ILLINOIS

25 years experience making spools and reels for the wire industry

GREETINGS TO THE WIRE ASSOCIATION CONVENTION

* * * * OUR SPARKERS * * * *

FOR THERMO-PLASTIC EXTRUSION, CONTINUOUS VULCANIZING, TWINNING, COILING, TWISTING AND SPOOLING

Are Approved By The Underwriters Laboratories.

WRITE FOR INFORMATION

R. L. DAVIS ELECTRIC COMPANY

WALLINGFORD, CONNECTICUT

Some Theoretical and Practical Concepts of Synthetic Insulants in the Cable Industry

(*Continued from page* 817)

38. Insulation
H. Warren
J.I.E.E.
Vol. 87, No. 528, p. 588
December, 1940

39. The Physics of Insulating Materials
A. Morris Thomas, B.Sc.,
World Power
Vol. XIV, No. LXXXIV, p. 485,
December, 1930
Vol. XV, No. LXXXV, p. 23,
January, 1931
Vol. XV, No. LXXXVI, p. 113,
February, 1931
Vol. XV, No. LXXXVIII, p. 388,
April, 1931

40. The Origin & Development of the Transmission Equation
R. Appleyard
Electrical Communication
Vol. II, No. 3, p. 183
January, 1924

41. An Analysis of Electromagnetic Forces
W. A. Tripp
Electrical Engineering
Vol. 64, No. 10, p. 351
October, 1945

42. The Basis for the Non-Destructive Testing of Insulation
R. F. Field
Trans. A.I.E.E.
Vol. 60, No. ...., p. 890
September, 1941

43. Experimental Researches on the Propagation of Electromagnetic Waves in Dielectric (Cylindrical) Guides
A. G. Clovier, V. Altovsky,
Electrical Communications
Vol. 18, p. 81, 1939

44. Recent Applications of Chemical Spectroscopy
H. W. Thompson, M.A., B.Sc., Phil-D.
Endeavour
Vol. IV, No. 16
October, 1945

45. T. Ostromislensky
German Patent No. 264,123 — 1912

46. W. L. Semon
U.S. Patent No. 1,929,452 — 1933

47. Walton, Quayle, Jones
British Patent Nos. 554,176 and 554,854.

New Company Formed to Produce Chlorinated Solvents

THE HOOKER-DETREX CORPORATION has been incorporated under the laws of the State of New York with a capitalization of 6,000 shares of preferred stock and 1,500 shares of common stock.

* * *

THIS is a corporation jointly owned by Hooker Electrochemical Company whose main office is located at Niagara Falls, New York and Detrex Corporation whose main office is located in Detroit, Michigan.

* * *

THE corporation has been formed for the purpose of manufacturing chlorinated solvents, the distribution and sales of which will be handled by the Detrex Corporation.

* * *

THE officers of the Corporation include **E. R. Bartlett**, President; **A. O. Thalacker**, First Vice-President; **R. L. Murray**, Second Vice-President and **G. E. Powers**, Treasurer.

* * *

THE site for manufacturing operations will be located in the Pacific Northwest where various materials are available and from which point distribution to West Coast markets will be handled. It is understood that the location will be adjacent to the property now occupied by the Hooker Electrochemical Company in Tacoma, Washington, between Alexander Avenue and Hylebos Waterway.

100 ft. of ACID Protection with Molded HAVEG

The above illustration shows a 100′ long sectional HAVEG continuous strip pickling tank—just before it left the HAVEG plant to take its place in an important WAR PRODUCTS plant.

HAVEG was selected for this job because it had proved itself unaffected by the acids commonly encountered in pickling processes.

HAVEG is unaffected by Muriatic Acid, any concentration—even at boiling; is unaffected by Sulphuric Acid up to 50% concentration, and a grade is available which is highly resistant to Hydrofluoric Acid.

HAVEG has strength, toughness and durability. It is unaffected by rapid temperature changes and can be used continuously at temperatures as high as 265°F.

Important to note is the fact that HAVEG *is not a lining* or *coating* but that its chemical resistance is constant throughout its entire mass.

HAVEG Equipment includes tanks, pipe, valves, fittings, fume duct, towers.

Bulletin F-3 gives complete technical, design and application data. Send for a copy today.

HAVEG-SARAN *Tubing; Pipe & Fittings; and sheets are available from stock.* **HAVEG-SARAN** *is also described in Bulletin F-3. Send for a copy now.*

HM-43A

HAVEG CORPORATION
NEWARK, DELAWARE
FACTORY–MARSHALLTON, DELAWARE

CLEVELAND 550 Leader Building
CHICAGO 1201 Palmolive Building
DETROIT 2832 E. Grand Blvd.
LOS ANGELES 601 W. Fifth St.

Yale Expands Light Electric Hoist Line with 2-Ton Unit

THE **Yale** line of Midget King electric hoists now includes a 2-ton model. Formerly the unit was available only in 1/8, 1/4, 1/2 and 1 ton capacities. The new size Midget King fits into many industrial applications where, heretofore, heavy-duty electric hoists were employed.

* * *

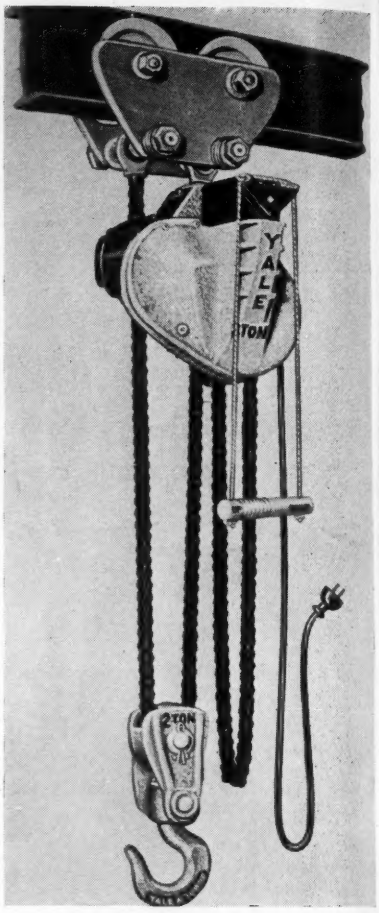
LIGHT in weight, yet producing plenty of fast lifting power, the compact 2-ton Midget King is equipped with a 1 H.P. motor. Lifting and lowering action is obtained by a flip of the wrist on the one-hand bar-grip control. The hoist operator thus has his other hand free to guide the load.

* * *

TO carry the load, a strong, light weight alloy steel roller chain is used. The load hook is of special steel which provides maximum safety for both load and worker—opens slowly without fracture before any other part of the hoist is strained to the yield point.

* * *

UPPER and lower limit safety stops prevent overtravel of the hook. The load brake and independently acting motor brake operate whether the power is on or off; both brakes, all wiring, and the controller are totally enclosed.



* * *

THE shaft and all gears are alloy steel, forged and hardened for maximum strength and long life. Precision bearings are used throughout. Oil bath lubrication protects all frictional parts against wear.

* * *

THE 2-ton Midget King Electric Hoist is available with hook for stationary use and with a permanently attached trolley for use on an overhead track. Accesories include a chain container for collecting slack chain, eliminating kinking and keeping the chain away from the worker and the load. To provide automatic electric cord support and feed when the Midget King is used on a trolley, a special device is available. Complete specifications and prices given in catalog P-577. Write The Yale & Towne Manufacturing Company, 4530 Tacony Street, Philadelphia 24, Pa.

USERS OF THESE CABLE REEL BORERS REPORT

PRODUCTION INCREASES UP TO 500%

In one single operation, this remarkable machine bores ALL the holes in a wooden cable reel head. In addition, it has the exclusive Root Patented Hydraulic Feed which provides a stepless range of feed from 2 to 29 strokes per minute. Operator is not handicapped by limited feed rate. This increases production tremendously. Can also be used for other boring purposes. Made in three sizes. *Write for Bulletin No. 132.*

"Can honestly say this machine alone has increased our production over 200%! Our profits increased 100%!"
V. Fairhurst, Mgr.
New England Reel and Lumber Co.

ROOT
HYDRAULIC FEED
REEL BORER

Root Reel Borer being used by New England Reel & Lumber Co.

B. M. ROOT CO YORK, PA.

AUTOMATIC
STRAIGHTENING AND CUTTING
MACHINES
equipped with
FLYING SHEAR
for
ROUND AND SHAPED WIRE AND ROD

THE HALLDEN MACHINE CO.
THOMASTON, CONNECTICUT

LACLEDE

FINE WIRE

PART OF LACLEDE'S FINE WIRE DEPARTMENT

MADE FOR YOUR PRODUCT WITH MODERN EQUIPMENT

LACLEDE WIRE IS MADE TO YOUR SPECIFICATION—QUALITY CONTROLLED FROM LACLEDE'S OPEN HEARTH TO FINISHED WIRE INSURES UNIFORM TEMPER, GAUGE AND FINISH.

WIRE FOR ALL NEEDS IN ALL GRADES AND FINISHES

BRIGHT OR BLACK ANNEALED
HIGH CARBON SPRING
LOW CARBON BRIGHT BASIC
TINNED, GALVANIZED
COPPER COATED — LIQUOR FINISHES
SIZES — .007 - .50 DIA.
COILS, SPOOLS, OR CUT LENGTHS

LACLEDE STEEL COMPANY
SAINT LOUIS, MISSOURI

Boron

SMALL quantities of boron added to certain steel alloys or used as a partial replacement for molybdenum in the same steels increase hardenability in the alloys, according to a report now on sale by the Office of Technical Services, Department of Commerce.

* * *

WRITTEN by M. C. Udy and P. C. Rosenthal, the report summarizes wartime research on the use of boron in steel alloys conducted at the Battelle Memorial Institute, Cleveland, Ohio, under the direction of the War Metallurgy Committee of the National Defense Research Committee.

* * *

ONE hundred boron-treated steels were tested in the research program described in the report. Nickel-chromium-molybdenum and manganese-molybdenum base alloy steels, in cast and wrought stock, were used in the tests.

* * *

FROM the standpoint of hardenability, best results were obtained with additions of .0015 to .002 percent boron, the researchers concluded. Boron additions had no apparent adverse effect on notch-bar toughness at temperatures down to minus 80 degrees Fahrenheit. A boron addition of .0015 to .003 per cent could be used to replace half of the molybdenum in aluminum-killed steels of certain compositions listed in the report. Full deoxidation of the melt was found necessary to avoid obtaining inconsistent hardenability results from the boron addition.

* * *

THE report lists other conclusions and gives a comprehensive description of the testing methods and results, illustrated by tables, graphs, and photographs.

* * *

National Electric Products Enlarges Plant

THE first project is rapidly approaching completion in the post-war plan expansion program of **National Electric Products Corp.**

* * *

THE rigid conduit department of the Ambridge, Pa., plant has been substantially enlarged. This has provided the adequate floor space needed for the new machinery required to meet the postwar demand for larger quantities of rigid conduit.

* * *

FOR the first time in National Electric plant construction, a generous use has been made of glass brick in the walls of the rigid conduit building.

* * *

Willey Issue New Catalogue

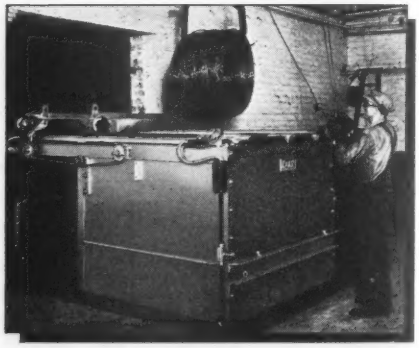
A NEW forty-page catalog covering their line of carbide tools, dies and other equipment has been published by **Willey's Carbide Tool Company**, 1340 West Vernor Highway, Detroit 1, Michigan.

* * *

THIS catalog contains many illustrations, prices and specification

SPEEDY,
SCALE-FREE
WIRE ANNEALING

★



Unique Ajax Electric Salt Bath Method provides fast, scale-free production—without decarburization. Cuts operating costs—greatly increases pot-life!

★

Added advantages in this modern, proved annealing method are—less floor space required, less labor, low maintenance cost, shorter time cycles (rarely over 20 minutes), no atmosphere equipment, no scaling, no explosion hazard. This modern electric salt bath annealing by the famous immersed electrode internal heating principle is ideal for annealing low carbon, high carbon and stainless steel wire and rod—in gauges from .020" to .250". Or for annealing aluminum, and copper and silver alloys. Also for descaling stainless and alloy steel wires in molten caustic soda. Recently developed salt mixtures greatly lower the cost of these operations. Interesting case-histories are available. Write for list of users.

AJAX ELECTRIC CO., INC.
FRANKFORD AND DELAWARE AVES., PHILADELPHIA 23, PA.
THE WORLD'S LARGEST MANUFACTURER OF ELECTRIC HEAT TREATING FURNACES EXCLUSIVELY!

THE AJAX ELECTRIC SALT BATH FURNACE
HULTGREN

ASSOCIATE COMPANIES:
Ajax Metal Co.—Ajax Electric Furnace Corp.—Ajax Electrothermic Corp.—Ajax Engineering Corp.

tables, besides a number of useful tables of information on the uses of the tools on different metals.

* * *

COPIES may be secured by addressing inquiries to the Company.

Watson-Standard Expands Vyncote Division

THE **Watson-Standard Company** of Pittsburgh has expanded its Vyncote Division in order to meet increasing demands for its series of vinyl plastic coatings for application in the metal products industry. The division now has independent technical and production personnel in a separate building which is complete with modern facilities for research and production.

* * *

EXPERIENCE gained through extensive wartime research has led to the development of vinyl plastics in solution for application to metal products including aluminum and mangesium. The Vyncote plastics form a flexible surface film that retains all the properties of solid plastics. The coatings resist water, grease, oil, chemicals, heat, etc.; and are adaptable to any baking cycle whether it is one of seconds or hours. Some suggested uses of the Vyncote prescription coatings compounded to individual requirements follow:

Coating for beer and food cans, oils cans, drums and pails.

Interior and exterior linings for collapsible tubes.

Lining for refrigerators and stoves and also as an exterior finish for both.

Chemical resistant lining for chemical containers of all types.

A special Vyncote coating for coil water heater jackets will resist heat as high as 500°F. in this application.

Vyncote is completely inert, nontoxic, tasteless and non-inflammable.

* * *

FOR many years plastic coatings were made with low solids and dissolved in relatively expensive solvents which were usually lost during the drying of the film. One of the Vyncote plastic coatings series is the result of a new method which utilizes inexpensive solvents and high solids, effecting important savings in application costs. Watson-Standard has recently developed one of these Vyncote series that is being supplied commercially at 60% solids. This coating gives excellent resistance to chemicals, grease and water and has remained stabilized under ultra-violet exposure for 24 hours without discoloration.

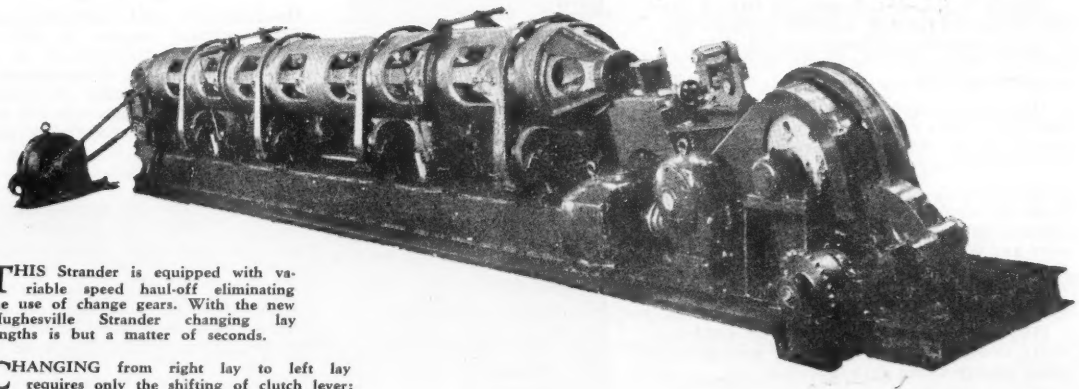
* * *

THE Wyncote series of prescription vinyl plastic coatings are available in colors or water-clear to suit individual requirements as to use and method of application. The manufacturer will be glad to send a Technical Data Folder on request.

* * *

ADVERTISING is a service to a magazine's readers. Methods, materials, and machinery are developing under the stress of war. Both editorial matter and advertisements keep you informed on what is happening in industry.

HUGHESVILLE 7-WIRE 9″ BOBBIN, HIGH SPEED TUBE TYPE STRANDER



THIS Strander is equipped with variable speed haul-off eliminating the use of change gears. With the new Hughesville Strander changing lay lengths is but a matter of seconds.

CHANGING from right lay to left lay requires only the shifting of clutch lever; electric brakes of latest type add much to the efficiency of operation.

THIS Strander is equipped with ball bearings throughout, has Textilite tube rollers and Carboloy wire guides, quick operating bobbin latches and bobbin brakes.

MADE FOR 9″, 12″, 16″ and 22″ standard bobbins.
Equipment for Wire and Rubber Industries.

HUGHESVILLE MACHINE and TOOL COMPANY
54 West Academy St., Hughesville, Pa.

A Review of Recent Wire Patents

No. 2,405,128, FORMING MACHINE, patented August 6, 1946 by Leonard G. Berquist, Niles, Mich., assignor to National-Standard Company, a corporation of Michigan.

For forming metal tubes of helically wound metal strip, it is stated this machine is so constructed that the space between the coacting forming rolls may be regulated very accurately by individual adjusting means.

★ ★ ★

No. 2,405,257, FENCE MACHINE, patented August 6, 1946 by Ernest Kehrer, Belle Vernon, and Clifford E. Faust, Monessen, Pa., assignors to Pittsburgh Steel Company, Pittsburgh, Pa., a corporation of Pennsylvania.

Complete Description and Drawings of Patents May Be Had for 50 cents, outside the United States and Canada $1.00. Address, Wire & Wire Products, 300 Main St., Stamford, Conn.

This assembly includes grippers for gripping the stay wires and moving them rearwardly into contact with the strand wires and, when the former are stationary, welding electrodes engage the contacting strand and stay wires and weld them together, whereupon the grippers move away from the welded stay wires into position to grip another set of stay wires.

★ ★ ★

MAINTENANCE DATA SHEET NO. 5

GEAR BOX LUBRICATION

Models DH, J, L-1, L-2, L-7, Q, and U: oil gear box periodically with a small quantity of SAE 30. Oil holes are provided at all necessary points. The friction side of the clutch must not be lubricated. If there is slippage, the pulling clamp will not return properly to the starting position. Remedy: wash the clutch face with gasoline or similar grease solvent. The enclosed gear attachment on the right side of the gear box should be inspected periodically and be kept packed with good grade gear lubricant.

Models X, X-2, X-3, X-4, L-3, L-4, L-5, and L-6: Keep gear box filled to proper level with SAE 40. If so equipped, check the multiple-speed box periodically and oil with SAE 30 as required.

Models L-3, L-4, L-5, and L-6 have a dash pot to control the action of the pulling clamp. A small quantity of Neatsfoot Oil should be poured through the tube of this dash pot about every six months.

IP-2 Tensilgraph and IP-2 Serigraph: oil gear box with a small quantity of SAE 10 regularly. Do not use oil excessively on the sliding shaft in the box.

IP-4 Tensilgraph: the gear box requires little attention; add SAE 50 on the worm reduction unit at infrequent intervals as necessary and oil the adjacent moving parts with a few drops of SAE 30. IP-4 Serigraph: maintain proper level in the gear box by adding SAE 20 periodically.

IP-2 and X-5 motors have gear reduction units, to be lubricated every six months with good quality worm gear lubricant.

Where V-belts are present care should be taken to avoid too great tension. Belt manufacturers will supply detailed instructions on operation and care.

Be sure your Maintenance Man has a complete set of these Scott Tester Data Sheets. Previous sheets sent free upon request.

REQUEST "CATALOG & DATA BOOK NO. 45" describing the many Scott Testers for testing textiles, rubber, wire, paper, etc., up to 1 ton tensile.

SCOTT TESTERS, INC.

55 BLACKSTONE ST., PROVIDENCE, R. I.

No. 2,405,296, BEDSPRING, patented August 6, 1946, by Charles J. Elder, Muncie, Ind., assignor to The Moore Company, Muncie, Ind., a corporation of Indiana.

More specifically, the invention resides in a rigid bar stabilizer between the base frame and upper frame of the bedspring.

★ ★ ★

No. 2,405,457, COIL WINDING FOR ELECTRIC APPARATUS AND METHOD OF MAKING SAME, patented August 6, 1946, by Allen T. Sinks, Beach Bluff, Mass., assignor to General Electric Company, a corporation of New York.

The apparatus and method are adapted for forming a coil of wire around the tubular wall at the bottom of pot type insulated transformers.

★ ★ ★

No. 2,405,725, APPARATUS FOR PRODUCING ANNULAR COMPRESSED WIRE MESH UNITS, patented August 13, 1946, by Otto H. York, Maplewood, N. J., assignor to Metal Textile Corporation, West Orange, N. J., a corporation of Delaware.

Molding apparatus is provided for producing such units of wire mesh fabric folded upon itself and compressed into a consolidated body mass.

★ ★ ★

No. 2,406,039, COATED METAL ARTICLE, patented August 20, 1946, by Milton J. Roedel, Wilmington, Del., assignor to E. I. du Pont de Nemours & Company, Wilmington, Del., a corporation of Delaware.

The metallic surface is coated with a film, not exceeding one mil in thickness, of a polymer of ethylene, which is then baked at a temperature above 200° C. in contact with an oxygen containing gas until the film becomes insoluble in solvent for the untreated polymer.

★ ★ ★

No. 2,406,130, COIL WINDING APPARATUS, patented August 20, 1946, by Edward D. Boyce, Little Falls, N. J., assignor to Bendix Aviation Corporation, South Bend, Ind., a corporation of Delaware.

Field coils for dynamo-electric machines are wound by this apparatus and it is stated that the time consumed in winding each coil is shortened.

★ ★ ★

No. 2,406,245, COATING FERROUS METALS WITH ALUMINUM, patented August 20, 1946, by Kasimir Oganowski, Franklin, Noel W. Parks, Lemon Township, Butler County, and Kenneth G. Coburn, Middletown, Ohio, assignors to The American Rolling Mill Company, Middletown, Ohio, a corporation of Ohio.

A hot-dipped ferrous article coated with an aluminum alloy is provided, in which the coating comprises an iron-silicon-aluminum-magnesium alloy, and a thicker external layer of high aluminum content and containing also silicon from substantially 7.5 to substantially 9.5%, and magnesium from substantially 2.0 to 2.5%, the ferrous article being characterized by ductility and high adherence of the coating.

★ ★ ★

No. 2,406,379, PICKLING BATH FOR FERROUS METALS, patented August 27, 1946, by Aaron D. Johnson, Wilmington, Del., assignor to E. I. du Pont de Nemours & Company, Wilmington, Del., a corporation of Delaware.

More specifically, the patent embraces a free-flowing, pulverulent addition to an aqueous acid solution to form the bath, and comprises from fifteen to thirty five per cent by weight of a liquid thiazolinyl sulfide dispersed on a finely divided solid soluble in a dilute aqueous acid bath in the concentration in which it would be added with the amount of thiazolinyl sulfide required to give the desired inhibition and having an average particle size of less than about five microns and a maximum particle size of less than about 200 microns.

* * *

No. 2,406,397, WIRE WINDING MACHINE, patented August 27, 1946, by David B. Parkinson, Maplewood, N. J., assignor to Bell Telephone Laboratories, Incorporated, New York, N. Y., a corporation of New York.

For winding wire upon a support from a spool, the inventor provides carriage means for holding the support against distortion and special windlass for automatically controlling the tension of the wire as it is run from the spool in the support.

* * *

No. 2,406,456, FISHHOOK MAKING MACHINE, patented August 27, 1946, by William J. De Witt and Herbert A. Corbett, Auburn, N. Y., assignors to Shoe Form Co., Inc., Auburn, N. Y., a corporation of New York.

This machine comprises a rotatable turret, a number of chucks mounted upon the turret, stationary platforms extending upon opposite sides of the path of movement of the chucks, a magazine for holding fishhook blanks, a drum located adjacent to the platforms and to the magazine and having grooves for receiving blanks from the magazine. The drum is rotated to feed the blanks one at a time from the magazine to the platforms, where intermittently operated feed fingers advance each blank from the platforms to a chuck.

* * *

Basic Water-Softening Methods

BASIC types of iron-exchanging water softeners for industrial, institutional and municipal use are explained in a booklet issued by **The Permutit Company**, 330 West 42nd Street, New York 18, N. Y.

* * *

THE water softeners, manufactured by The Permutit Company, are of both pressure and gravity types which feature automatic equipment to control backwashing, brining and rinsing processes. Copies of the booklet can be had upon written request to the company.

* * *

G. E. Appoints Collins as Manager of Resin and Insulation Materials Division

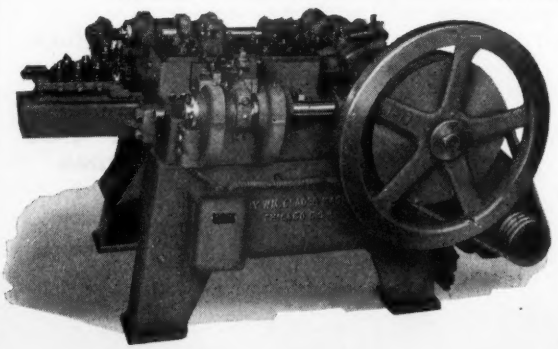
HARRY K. COLLINS has been appointed Manager of the **Resin and Insulation Materials Division** of the **General Electric Company,** it was announced in June by **Dr. Zay Jeffries,** vice president of the company's Chemical Department. The position was formerly held by the late **Edgar L. Feininger** who also held the title of assistant general manager of the Chemical Department.

* * *

MR. Collins, who was Manufacturing Manager of the division in Schenectady, now assumes responsibility for over-all activities connected with General Electric's new silicone resins, oils, greases, rubber and water repellents as well as its Glyptal alkyd resins and insulating materials.

* * *

GLADER HIGH SPEED WIRE NAIL MACHINE



MACHINE ARRANGED FOR INDIVIDUAL MOTOR DRIVE

High tonnage output, and low maintenance costs, have resulted in Glader Machines being accepted as standard equipment in every large nail mill built in the United States in the past twenty years.

Glader Machines are operating in most of the wire producing mills throughout the world.

These machines are made in eleven different types and sizes. This enables us to cover the range of sizes of nails produced with the greatest efficiency.

For further information please address,

WM. GLADER MACHINE WORKS

210 No. Racine Ave.
Chicago 7, Illinois

WILLEY'S SIZING, EXTRUSION AND

Sales Engineers in Principal Cities.

WIRE DRAWING DIES

They are made from a specially developed grade of Tungsten Carbide having those characteristics needed for dies—freedom from porosity, great abrasion resistance and the ability to take a polish equal to that of diamonds.

FOUR CLASSIFICATIONS OF WILLEY'S DIES

A. Blank and rough cored nibs.
B. Rough cored dies (cased).
C. Semi-finished, rough drilled dies (cased).
D. Finished dies, ready for use.

WRITE FOR NEW CATALOG 29

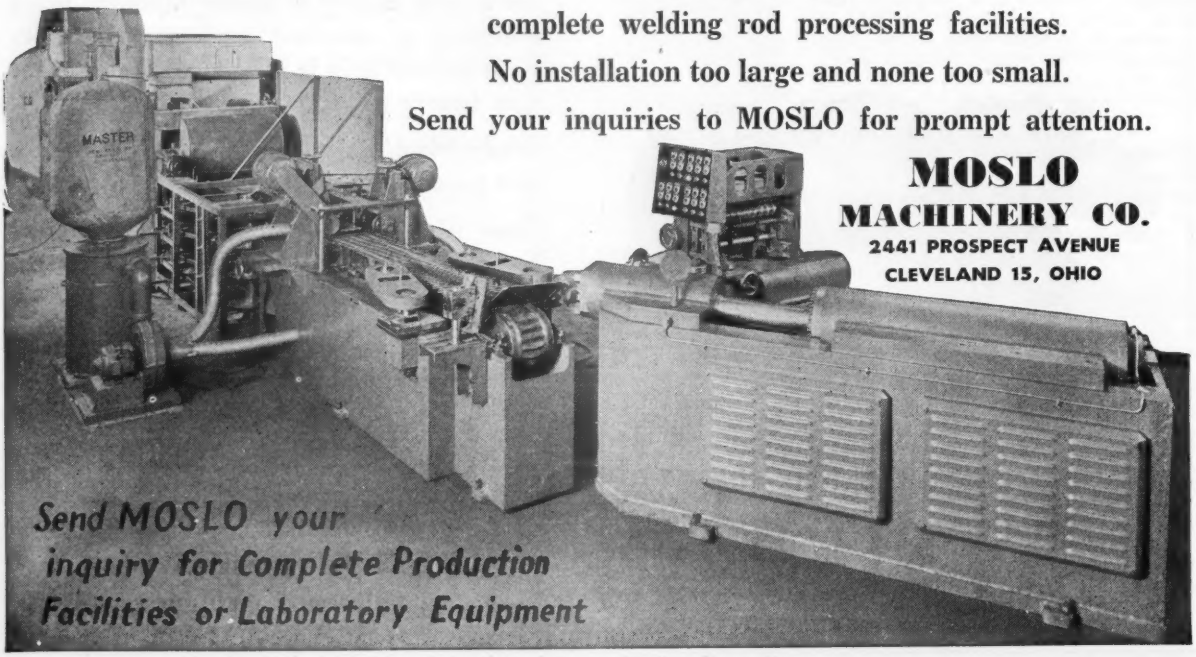
Gives full information on Willeys Dies in addition to other standard tools.

Standard Sizes from .325 to 4.000. Special Sizes and Shapes Made to Order.

WILLEY'S CARBIDE TOOL CO.
1340 W. Vernor Highway, Detroit, Michigan

SPECIALISTS

in the production of
complete welding rod processing facilities.
No installation too large and none too small.
Send your inquiries to MOSLO for prompt attention.



MOSLO MACHINERY CO.
2441 PROSPECT AVENUE
CLEVELAND 15, OHIO

New Developments in Pickling for the Rod and Wire Industry

THE **William M. Parkin Company**, industrial cleaning specialists, have announced an interesting new development for better and more successful acid cleaning operations. The product, **NEPTUNE**, is a liquid accelerator and has shown remarkable results in several rod and wire mills to date.

* * *

THE addition of a few quarts enables the pickling foreman to operate at lower temperatures and still maintain the same cleaning cycle. The presence of this accelerator in the dilute acid solutions (sulphuric and muriatic) allows solution to work faster on the steel and result in a cleaner pickle.

* * *

WITH reduced pickling temperatures (one large wire mill is now pickling at 35 to 40 degrees lower temperatures), less steam and fumes leave the tanks in the volatile state.

* * *

SEVERAL cleaning house foremen have noted that their acid solutions last longer with the addition of small quantities of this product. The Baume of the tanks is held down. The iron content builds up slower than formerly.

* * *

A wire mill in the Pittsburgh district reported a cleaner product from their acid solutions. (This accelerator is added to the dilute acid solutions along with any inhibitor or foaming compound which may be employed. It is not the same chemically as the present day organic inhibitors.)

* * *

ONE wire mill in the East was experiencing considerable trouble with acid fumes from the cleaning tanks annoying the surrounding community. City officials threatened action unless the objectionable and damaging fumes, spray, etc., were eliminated. Finally, after considering the possibility of an elaborate exhaust fumes system, it was found that the presence of this accelerator in small portions in the acid cleaning tanks completely eliminated the difficulties. Fumes, acid spray and so on were held down completely.

* * *

IN muriatic acid cleaning prior to galvanizing wire, it has been noted that this product promotes a cleaner and brighter product.

* * *

CONCLUSION: The addition of this liquid accelerator to rod and wire acid cleaning operations has shown the following results: (1) Pickling at reduced temperatures without slowing down the normal cleaning style. (2) Holding down the iron content of the solutions. (3) A reduction of the usual acid spray and fumes which are always objectionable both to workers and damaging to surrounding structures. (4) A chemically cleaner and better finished product.

* * *

SOMETHING *New* FOR IMPROVED ACID CLEANING OPERATIONS

NEPTUNE PICKLING ACCELERATOR

1. *Permits pickling at lower temperatures without slowing down the cycle.*
2. *Extends the life of the acid solutions by holding down the iron content.*
3. *Reduction of objectionable acid spray, fumes, etc.*
4. *Chemically clean finish on the steel.*
5. *Reduces dragout and waste of acid solutions.*

Samples and complete information furnished on request.

THE WILLIAM M. PARKIN COMPANY

Industrial Cleaning Specialists

Highland Bldg., Pittsburgh 6, Penna.

Also producers of the RIGHT COMBINATION, "NEP" and "SUMFOAM", for lower pickling costs.

Electronic Micrometers Measure Compressible or Non-Compressible Materials

CARSON MICROMETER CORPORATION, Newark, N. J., announce production of four redesigned models of their Electronic Micrometers for precise thickness measurement in the shop or laboratory. Outstanding feature is the electronic circuit used in conjunction with the micrometer screw threads. Electronic discrimination thus replaces the human sense of touch; and "feel" has been completely dissociated from operation of the instrument. Unskilled operators therefore are assured of consistently accurate readings to .00005" on production testing lines.

* * *

ORIGINALLY developed to fill the need for a "pressureless" instrument for measuring drift and deflection in coil springs, these unique instruments will now measure thickness of compressible or non-compressible materials as well as conducting or non-conducting materials. Their precision is unaffected by variations in temperature, line-voltage, vibration or aging of electronic tubes, nor do they require leveling. Carson Electronic Micrometers feature extreme sensitivity to deviations as small as .000025" over a full one inch range and will measure soft or compressible materials precisely. Units are portable and weigh but twenty pounds, complete. Model L, designed to meet the need for pressureless measurement of conducting parts, is being used for inspection, sorting, grading and measurement of machined parts, ball bearings, radio tube grids, small assemblies and depth of counterbore, as well as deflections of diaphrams and springs.

* * *

MODEL M was developed for measuring diameter and out-of-round condition of fine, soft-annealed wire. It will register precise dimensions of paper, ribbon, strip, foil, cork, rubber, felt, plastic, linoleum, photographic film and textiles. Model W, for pressureless measurement against conducting surfaces. Used in the laboratory measurement of deflections and drift in springs, diaphrams, bi-metal elements, bellows, and similar applications requiring measurement without pressure. Model S, for production testing of tension and compression springs; set testing of diaphrams and metal bellows, flat springs and thermostatic elements. Lower table will support a 150-pound load.

* * *

COMPLETE details are described in a bulletin which will be supplied upon request. Write Carson Micrometer Corporation, 28 Edison Place, Newark 2, N. J. Dept. 51.

Aluminum Screen Cloth

AMONG the marvels seen at the Columbian Exposition in 1893 was a sample of aluminum screen cloth. It was woven and exhibited by **Gilbert and Bennet Manufacturing Company of Georgetown, Connecticut,** and was shown along with specimens of gold and silver cloth.

* * *

THIS aluminum screening, probably the first ever produced, was woven from .0095 inch diameter aluminum wire. "Commercially pure" metal was used.

* * *

THE first recorded use of aluminum screening was made in

Warner

BELL-MINE LIME

for

WIRE DRAWING

WARNER COMPANY

BELLEFONTE DIVISION

BELLEFONTE, PENNSYLVANIA

Sales Office

Philadelphia . . . Pittsburgh . . . New York

1899, for the windows of a Pittsburgh, Pa., residence. The screens saw twenty-two years of continuous use and were removed in 1921 when the residence was dismantled. Examination at that time revealed that the screen wire was still in good condition.

* * *

THE relatively low strength of the early aluminum alloys handicapped screen manufacturers. In 1931 a new aluminum-magnesium alloy was developed from screen wire with drawing characteristics markedly superior to alloys previously used. A slight additional change in the composition of the alloy, made in 1936, further improved the mechanical properties and drawing characteristics of this alloy. These later aluminum alloys have proved highly satisfactory for screen manufacture.

* * *

TODAY'S aluminum screening utilizes wire of different diameter and hardness for warp and filler. A typical combination consists of a filler wire of .0138 inch diameter **Alcoa Alclad** 56S-H with a warp of .0126 inch diameter **Alcoa Alclad** 56S-T3. A heavier diameter wire than this is used for special purposes.

* * *

ALCLAD wire, manufactured by **Aluminum Company of America**, consists of a high strength alloy core with a coating of a different composition which has been employed for the past half dozen years to insure maximum protection again corrosion.

* * *

IMMEDIATELY after weaving, the aluminum screening is given a protective paint coating consisting of a good varnish base plus aluminum powder. In addition to its protective properties this paint coating serves to give the screening a more uniform and pleasing appearance. Aluminum screening does not rust, nor stain adjacent masonry or woodwork.

* * *

MANUFACTURERS report that orders on their books for aluminum screening run into many millions of feet, but this amount will scarcely make a dent in the potential market. It is estimated that approximately three billion square feet of metal screening of all types is in use today and about one-third of this amount is in need for immediate replacement.

* * *

Allegheny Ludlum Licenses British Firm to Produce Patented Alloys

IN its quarterly report to stockholders, **Allegheny Ludlum Steel Corporation** announced the licensing of **Darwins, Ltd.**, large British steel producer, for the manufacture and distribution of the local company's recently developed high temperature alloys.

* * *

THE license is to be effective throughout the British Empire excluding Canada and covers four grades now patented. Representing an Allegheny Ludlum World War II development, these super alloys were cloaked with secrecy during the war because their ability to withstand high temperatures and stresses made their use vital in aircraft turbo-superchargers and jet propulsion.

1926 – pioneered the first practical controlled-atmosphere furnace

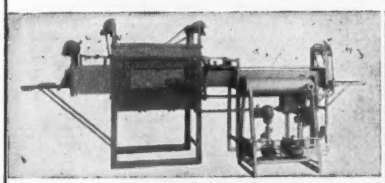
"Certain Curtain" ELECTRIC FURNACES

TODAY – providing the most advanced types of controlled-atmosphere furnaces

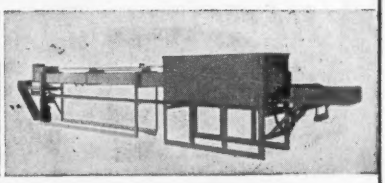
CLEAN

annealing
copper brazing
silver soldering

"CERTAIN CURTAIN" ELECTRIC FURNACES



Type LA, for soldering, brazing and annealing, with external atmosphere generator.



Type LAC, for conveyor soldering, brazing and annealing.

Finest controlled atmosphere results

The famed "Certain Curtain" controlled-atmosphere furnaces increase speed of production, decrease spoilage, often entirely eliminate cleaning and pickling operations. Three types of atmosphere preparation and control give you precision and completeness of atmosphere protection assuring clean, uniform work of maximum working life. Our line also includes furnaces for hardening tools and dies, conveyor hardening of small parts, sintering, brazing carbide tool tips, tempering, etc.

Write for "CATALOG 108"

C. I. HAYES, INC. 129 Baker St., Providence, R. I.

Outstanding Personalities of the Wire Industry

Ralph K. Clifford Elected President Continental Steel Corp., Kokomo, Indiana

AT the regular monthly meeting of the board of directors of **Continental Steel Corporation** held recently at the company offices, the retirement of **D. A. Williams** as president of the corporation as of the close of the present year was approved by the board in accordance with the desire of Mr. Williams made known some time ago. On next January 1, Mr. Williams will become chairman of the board of directors, which office has been vacant since the death of J. E. Fredrick.

* * *

AT the same meeting **R. K. Clifford** was chosen to succeed Mr. Williams as president of the corporation.

* * *

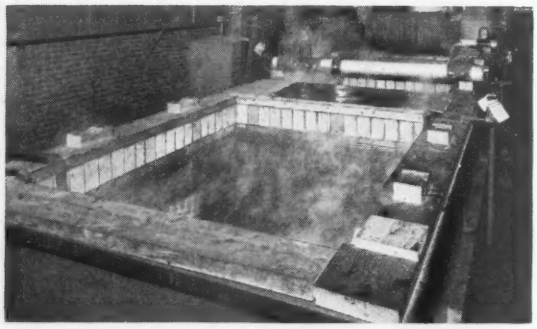
RALPH K. CLIFFORD
President, Continental Steel Corp., Kokomo, Ind. Past President, The Wire Association.

MR. Williams has been a resident of Kokomo since 1927, having moved here from Louisville, Ohio, to take up his duties as vice president of the newly formed Continental Steel Corporation at that time. He became president of the organization on January 1, 1931 and has continued in that capacity up to this time.

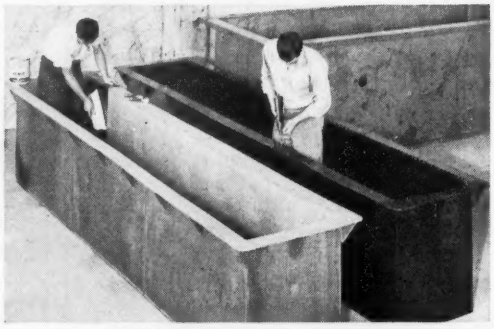
* * *

MR. Clifford was born in Kokomo and is a graduate of the local high school and of the University of Michigan. His employment with the company goes back to various jobs performed while still in high school and college, later becoming chief chemist, then superintendent of the Kokomo Steel and Wire Company. He was named vice president in charge of operations of Continental in 1939, director in 1941, vice president and general manager in 1944. Mr. Clifford is a past president of The Wire Association and a present member of the Board of Directors.

WELCOME TO BUFFALO! *home of* **NUKEM ACID-PROOF TANKS AND MATERIALS**



NUKEM pickling tank construction has long been a standard in the wire and wire products industry. Acid, alkali, leak and wear proof, these tanks are designed to give years of trouble free service under the most severe conditions. Tanks by Nukem are an investment, not a cost. Long successful experience in the field enables Nukem to supply the effective answers for all types of pickling, chemical process or storage tank difficulties. For prompt service without obligation, consult Nukem on your corrosion problems.



NUKEMITE — This synthetic coating is immune to all commercial acids, alkalies, salt solutions and most solvents. Applied like a paint, this solution air dries to form an impenetrable durable film of exceptionally strong adhesion. Desirable properties of flexibility and elasticity are retained. Where it is to be used as a membrane lining for tanks, it may be applied in sheet form as illustrated above. It is an unexcelled protective coating for structural work, floors, processing equipment, etc., where corrosive conditions exist.

NUKEM PRODUCTS CORP. 117 Colgate Ave., Buffalo 20, N. Y.

Steinkraus Re-Elected President and Made Chairman

HERMAN W. STEINKRAUS has been elected chairman of the board of directors of the **Bridgeport Brass Co.**, Bridgeport, Conn., to succeed the late William R. Webster. **Walter R. Clark** has been named vice-president in charge of engineering; **Herbert W. Jones,** vice-president in charge of finance; **Mead W. Batchelor,** vice-president in charge of production; **Austin R. Zender,** vice-president in charge of sales; **Rowley W. Phillips,** secretary; **William R. Breetz,** treasurer; **M. K. Schnurr,** comptroller; **Everett Japp,** assistant treasurer and assistant secretary; **Warren Faust,** assistant treasurer; **John Dawson** and **A. Dean Merwin,** assistant secretary.

* * *

C. W. Hagenbuch, Asst. Vice President Sheffield Steel Corporation

C. W. HACENBRUCH has been appointed assistant vice president, **Sheffield Steel Corp.**, Kansas City, Mo. Mr. Hagenbuch joined the company, then known as the Kansas City Bolt & Nut Co., in 1920. Under his direction as assistant vice president will be the development and merchandising of new products, as well as overall production and mill scheduling of all Sheffield products.

* * *

John C. Morris

APPOINTMENT of **J. C. Morris** as superintendent of manufacturing of the **Resin and Insulation Materials Divisions** of the **General Electric Chemical Department** has been announced by Harry K. Collins, division manager. Mr. Morris has been assistant superintendent for the past year.

* * *

MR. Morris has been associated with General Electric for 18 years starting in the payroll section in 1928 and a year later transferring to the induction motor cost section. In 1931, he transferred to the mica cost section and four years later was named cost section head and supervising clerk.

* * *

MR. Morris was named assistant to the superintendent of the mica section in 1940 and was promoted to assistant superintendent in 1943. Two years later he was named assistant superintendent of the Resin and Insulation Materials Division.

* * *

A native of Fair Haven, Vermont, Mr. Morris graduated from Wesleyan University in 1927 with a Bachelor of Science degree.

* * *

Cyclone Fence Announces Staff Changes

SEVERAL changes among sales officials in the Cleveland and Newark areas were announced here today by **R. E. Pinniger,** vice president and general manager of the Cyclone Fence Division of American Steel & Wire Co., a U. S. Steel subsidiary.

* * *

CARL A. Ten Hoopen, for 12 years sales manager of the Cyclone Central District, with headquarters in Cleveland, has been ap-

WIRE SPOOLING
OUR SPECIALTY

BUT WE WILL SPOOL ANYTHING YOU HAVE

—— PERMIT THIS MACHINE ——
TO DO YOUR EXTRA SPOOLING

90 Head Available — Low Price — Good Spooling
Quick Delivery — Write, Phone or Wire.

* * *

Why Not Allow Us To Quote You

* * *

JERSEY SPECIALTY CO.
LITTLE FALLS 4-0784. **LITTLE FALLS, N. J.**

pointed Eastern district sales manager, with headquarters in Newark, N. J. He succeeds **S. W. Burr**, who will handle special sales assignments for the company.

* * *

THOMAS S. Humrickhouse, for 17 years manager of the Cyclone office in Pittsburgh and since 1942 assistant Eastern district manager at Newark, succeeds Mr. Ten Hoopen as manager at Cleveland. A native of Coshocton, O., Mr. Humrickhouse has been with the company for 22 years. He is married and has two daughters.

* * *

MR. Ten Hoopen, a native of Cleveland, is a graduated of Case School of Applied Science. In his 25 years with the Cyclone organization he has been stationed at Nashville, Detroit and Columbus, prior to his Cleveland assignment in 1934. He has been active in the Cleveland Chamber of Commerce, Cleveland Sales Executive Club, Cleveland Athletic Club, and Case Alumni Association. He is married and has one son, now with the Army in Europe.

* * *

ESTABLISHMENT of a separate sales district for Michigan with headquarters in Detroit and **E. B. Wilhelm** as manager, also was announced. The state was formerly part of the Central district, which now includes Ohio, Kentucky, West Virginia, and parts of Tennessee, Pennsylvania and New York. Sub-offices are maintained in Cincinnati, Columbus, Pittsburgh, and Buffalo. The company's Eastern district embraces the eastern seaboard, from Virginia to Maine. Sub-offices are in Washington, Hartford, Philadelphia, New York City, Albany, and Mineola, L. I.

* * *

MR. Poole, a graduate of Kansas State College, joined General Electric in 1934 as a student engineer. In 1936 he entered the company's Industrial Control Engineering division, and was transferred a year later to the Steel Mill Division of the Industrial Engineering Divisions. He remained in this capacity until January of this year, when he was appointed engineer-in-charge of the Machinery Division. Mr. Poole has worked mainly as an application engineer on steel mill electrical equipment.

* * *

MR. Rhoades was graduated from Union College, Schenectady, in 1935. He entered General Electric in the same year on the test course, and later was transferred to the Motor and Generator Engineering division. He remained with that division for three years before joining the Industrial Manufacturers Division of the Industrial Engineering Divisions, where he has worked since.

A FAR CRY SINCE THE 14TH CENTURY

Wire was originally made by beating the metal out into plates, which were then cut into continuous strips, and afterwards rounded by beating.

BUT WIRE TODAY IS ONLY AS DEPENDABLE AS ITS MAKER

At Wickwire Brothers Mills in Cortland we begin by making our own steel.

We draw the wire to rigid specifications on modern machines. Many of our own special processes are used—you get over 70 years of knowledge and experience built into our products.

WIRE, plain, galvanized, coppered, tinned, in coils, on spools or straightened and cut to length—in all sizes.

WICKWIRE BROS., INC.
CORTLAND, N. Y.

SPECIFY CORTLAND BRAND WIRE

TO WIRE MILL MEN

Have you considered joining the Wire Association? You are cordially invited to become a member. Dues are $15.00 a year, which includes a subscription to WIRE & WIRE PRODUCTS and a copy of the Annual Buyers Guide.

THE WIRE ASSOCIATION
300 Main Street,
Stamford, Conn.

New Plastic Material

A NEW method of processing a plastic material to afford a protective means for a host of industrial products has been announced by the **General Electric** plastics division.

* * *

POSSESSING good electrical, physical and chemical properties, the material is tough, durable and resilient as well as water, acid and alkali resistant. It has good wet strength and will not split while it is being applied or during prolonged storage. The method of processing and its ease of application already has made it suitable for a wide range of products and offers unlimited possibilities for many other fields.

* * *

USE of the material is twofold. It may be incorporated in the design of the product itself such as a covering for busbar insulation, as terminal ends or as an electrical mechanical seal for wires and tubing. At the present time it is more extensively used as a temporary protective during storage and shipment or during the fabricating and manufacturing processes of the finished product. Illustrative of the former is its use as coverings for cable ends, grips for pliers, wrenches and wire-cutters for insulating purposes. One of its best applications is to form a protective covering for threaded parts of various types of equipment.

* * *

THE material is available in the form of caps and sleeves. Processing calls for a special dilator solution developed by G. E. in which the material is immersed for a period of two to four hours. This expands the material as much as half again its normal size. While dilated the unit is placed in position on the product and is allowed to dry. It soon shrinks to smaller than its original size and forms a tight fit around the product without losing any of its physical properties. It may be easily removed by cutting with a knife.

Willey's Universal Angle Protractor

THE new universal angle protractor, just announced by **Willey's Carbide Tool Co.**, can be used on all makes of carbide tool grinders and provides a dual change of angles from 0° to 90°. This unique feature greatly speeds up production by permitting the grinding of two tools simultaneously, at the same or different angles.

* * *

WILLEY'S Universal Angle Protractor, while designed primarily for grinding applications, also lends itself to a variety of operations, such as acting as an angular guide for drilling, grooving and milling.

* * *

THE key is a separate unit which is studded to the body of the adaptor and slides on four steel balls which provide constant thrust and mobility.

* * *

FULL information may be had by writing Willey's Carbide Tool Co., 1340 W. Vernor Highway, Detroit 1, Michigan.

TUNGSTEN — CARBIDE DIES

STANDARD & SPECIAL

COLD HEADING and EXTRUSION DIES

Wire Drawing Dies — Tubing Dies — Coating Dies — Sizing Dies —Ring Gauges — Cut-off Quills. Also Manufacturers of Diamond Dies & Diamond Powder.

For Immediate Delivery on Standard Boltmaker & Extrusion Dies, Wire Drawing & Tubing Dies, Address Inquiries to: —

MICHIGAN WIRE DIE COMPANY

11152 CHALMERS AVE. DETROIT 5, MICHIGAN

Phone: Pingree 5702

COVERING The Wire and Wire Products Industry IN CANADA

The A. R. Williams Machinery Company, Limited, with offices in seven principal Canadian cities, is proud to represent for the Dominion, the following well-known firms:

THE TORRINGTON MANUFACTURING COMPANY
Torrington, Conn.

JAMES L. ENTWISTLE CO.
Pawtucket, R. I.

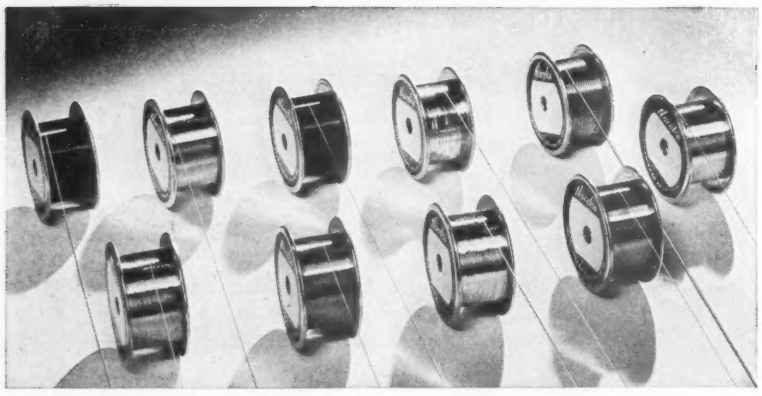
FIDELITY MACHINE COMPANY INC.
Philadelphia, Pa.

CARBOLOY DIVISION,
CANADIAN GENERAL ELECTRIC COMPANY LIMITED
Toronto, Canada

IF IT'S MACHINERY WRITE WILLIAMS — CANADA'S LEADING MACHINERY HOUSE

THE **A.R.WILLIAMS MACHINERY** COMPANY LIMITED

HALIFAX MONTREAL OTTAWA TORONTO WINNIPEG CALGARY VANCOUVER VICTORIA



FINE WIRE... drawing fine wire with rigid requirements of close tolerance, perfect roundness and faultless surface condition is an everyday production accomplishment at North American Philips. If your specifications call for fine wire below .003 diameter in silver, nickel, copper, aluminum alloy, resistance wire *or* plated wires up to .010 such as gold, copper and nickel on silver, tungsten, molybdenum, alloys, etc.—bring your problem to Fine Wire Headquarters.

Norelco Reg. U.S. Pat. Off. ELECTRONIC PRODUCTS

NORTH AMERICAN PHILIPS COMPANY, INC. DEPT. WP-10, 100 EAST 42nd ST. NEW YORK 17, N. Y.

Utility Company Finds Electric Truck Useful

THE Boston Elevated Railway Co. has found battery-powered industrial trucks serve well in solving the problem of expediting maintenance. Comprising both low and high lift trucks, the duties assigned by this Massachusetts utility to its four electric trucks include the movement of repair parts between stores and repair departments. The battery-powered high lift truck pictured has been assigned the task of bringing a heavy skid load of wire and other maintenance materials from the receiving dock to storage aisles. Such trucks operate with equal efficiency within the repair and storage buildings, or along the roads of the car yards.

* * *

Alloy Metal Wire Company Announcement

JUST off the press, catalog D-2 of **Alloy Metal Wire Company,** Prospect Park, Pa., is the only complete modern catalog on Monel, R Monel, K Monel, KR Monel, Nickel, Z Nickel, and Inconel wire, rod, and strip. This catalog contains the latest technical information on the above high Nickel alloys. There are complete references, tables and charts to guide you in selecting the proper Nickel alloy and its fabrication. There are many illustrated applications to show you how every industry saves money using high Nickel alloys. Alloy Metal Wire Company's engineering services are also outlines.

* * *

IF you desire this booklet write Dept. W - Alloy Metal Wire Company, Prospect Park, Pa.

Self-Emulsifying Solvent Utilizes "Constant-Float" Protection

A NEW, self-emulsifying, water-mixable solvent, called Oakite Composition No. 98, that removes light shop dirt and non-pigmented stamping compounds from steel and aluminum work, has been made available by **Oakite Products, Inc.**, for use primarily in pressure-spray washing machines.

* * *

NON-TOXIC, non-flammable in solution, the new material is reported to have important self-cleaning properties and employs the principle of "constant-float protection". The lighter-than-solution soil floats at the top of the cleaning tank to blanket and protect the clean solution underneath, retards foaming and prevents material loss by evaporation. The "floating layer" is periodically skimmed or caused to overflow to avoid excessive thickening. The new solvent also prevents formation on clean work of water spots, which often show through clear lacquer and other types of organic finishes.

* * *

FIELD tests conducted during the past year in metal-cleaning operations indicate that working concentrations for Oakite Composition No. 98 range from one to two per cent by volume.

* * *

A FREE Service Report giving details may be secured by writing on company letterhead to Oakite Products, Inc., 52A Thames Street, New York 6, N. Y.

Roebling Installs New Manufacturing Facilities in California

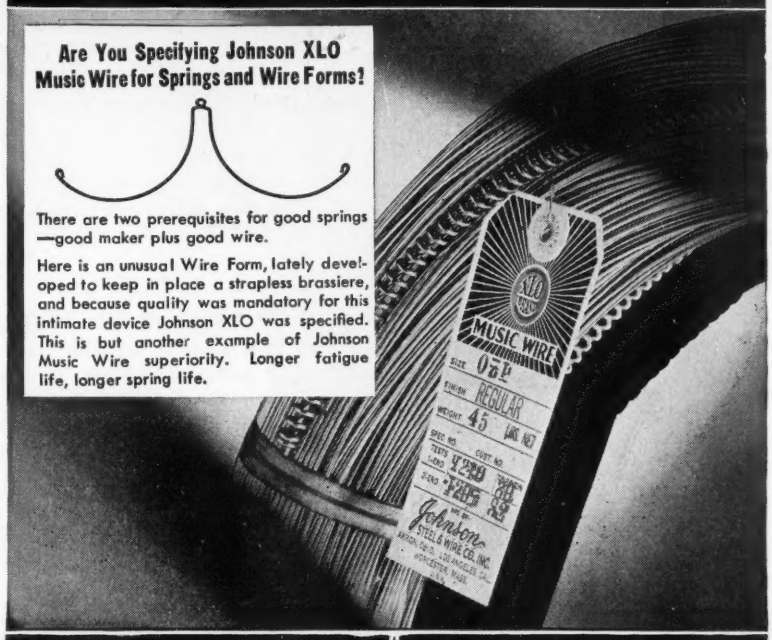
NEW equipment for the manufacturing of Roebling Lock-Clad Aircord, a development which provides improved sensitivity of control at any altitude, is now in operation at the Los Angeles assembly plant of the **John A. Roebling's Sons Company** of California. The installation of these additional facilities as an adjunct to the main plant at Trenton, New Jersey, will provide exceptional delivery service for all points, as well as increased production capacity for a full range of Air Controls.

JOHNSON

Are You Specifying Johnson XLO Music Wire for Springs and Wire Forms?

There are two prerequisites for good springs —good maker plus good wire.

Here is an unusual Wire Form, lately developed to keep in place a strapless brassiere, and because quality was mandatory for this intimate device Johnson XLO was specified. This is but another example of Johnson Music Wire superiority. Longer fatigue life, longer spring life.



JOHNSON STEEL & WIRE CO., INC.
WORCESTER 1, MASSACHUSETTS.
NEW YORK AKRON DETROIT CHICAGO LOS ANGELES TORONTO

A Modern and Better GALVANIZING FLUX

A LETTER BRINGS A MAN

to tell you about it!

IT has been proved that No. 20 Galvanizing Flux offers results which hot galvanizers have been looking for. Briefly this: more *ductile*, more *adherent* coatings —at *lower operating costs*.

A letter from you will bring full details, or an H-VW-M engineer to explain all the features and advantages of No. 20 in person.

And here's additional good news: When you have the facts and have decided to try No. 20— as we think you will—you can get *prompt shipment* right from stock.

No. 20 Galvanizing Flux is modern, it's better, it's available in a hurry. Get the whole story. Write H-VW-M today.

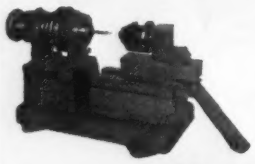
1433

HANSON-VAN WINKLE-MUNNING CO.
MATAWAN, NEW JERSEY
Manufacturers of a complete line of electroplating and polishing equipment and supplies
Plants: Matawan, New Jersey · Anderson, Indiana
Sales Offices: Anderson · Chicago · Cleveland · Dayton · Detroit · Elkhart
Matawan · Milwaukee · New Haven · New York · Philadelphia
Pittsburgh · Rochester · Springfield (Mass.) · Syracuse

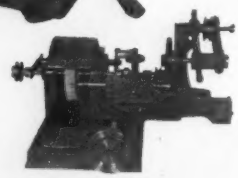
HANSON-VAN WINKLE-MUNNING CO. MATAWAN, NEW JERSEY U.S.A. SINCE 1820

NEW DIE ROOM FINISHING *MACHINERY* DIE ROOM TOOLS and EQUIPMENT

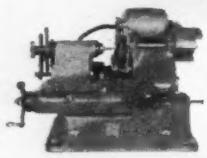
For speeding up production of Tungsten Carbide Dies and making lapping pins faster and with regular die room help. No special skill required.



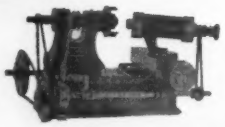
NEW DYRO PIN MAKER



NEW ROOS PIN GRINDER



NEW PARK PIN GRINDER



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All sizes LAPPING PINS
Prompt shipment on orders of 1 to 1,000.

And New PIN GAUGE
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Write for details.

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ROOS TOOL & MFG. COMPANY
Plant and Shipping Point
17 Grove Street, Montclair, N. J.
Sales Office
49 Bloomfield Avenue, Newark 4, N J

Two New Low Temperature Silver Brazing Alloys

WITH the price of silver increased approximately 20 cents per troy ounce the two new silver brazing alloys featuring lower silver content just announced by **Handy & Harman** should be of great interest to everybody working in metals. The new alloys are called Easy-Flo 45 and Easy-Flo 35.

* * *

AS its name implies, Easy-Flo 45 is a 45% silver alloy. In addition, it contains copper, zinc and cadmium. One of its exceptional features is a new low melting range — 1120° F. to 1145° F. The joints produced between ferrous, nonferrous and dissimilar metals are strong, ductile, leak-tight. It offers the full advantages of alloys with a higher silver content but due to less silver in its composition provides an economy to help offset the increase in the price of silver. The 35% alloy has characteristics quite different from Easy-Flo 45. It has wider melting range — 1115° F. to 1295° F. — and is free flowing at an exceptionally low temperature for an alloy containing 35% silver. It offers an opportunity for manufacturers to economically produce joints between ferrous or non-ferrous metals which are high in strength and ductility and is appropriate to use in places where a higher working temperature is not objectionable.

* * *

THESE two alloys have been developed in the Handy & Harman laboratories during the past two years. They are the most recent creation of a continuous research through which this manufacturer is constantly seeking to provide industry with the best alloys that can be developed to further the use of this popular method of metal joining. Complete details about the new Easy-Flo 45 and 35 can be obtained from Handy & Harman, 82 Fulton Street, New York 7, N. Y.

Removable Self-Starter Strip exposes ends of Labels for you to peel!
DON'T PICK. USE SELF-STARTER STRIP TO PEEL LABELS
QUIK-LABEL
Code Card System
FREE SAMPLES
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QUIK-LABELS
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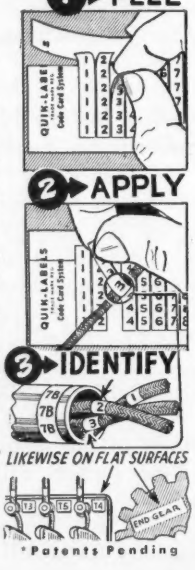
QUIK-LABELS code Wires, Leads, Circuits, Relays, Parts, etc. faster and cheaper. • *Pre-cut* to exact size, QUIK-LABELS come in rows on handy Cards, stick without moistening. • Replace slow and costly string tags, roll tapes, decals, stencils, metal tabs, etc. • Coated with clear insulating varnish to resist dirt, grease, abrasion. • Removable *Self-Starter Strip automatically exposes ends of Labels for you to grasp instantly—no more finger-picking. • Cost less to buy-and-apply than all other markers. • Maintenance men carry Cards to the job. • QUIK-LABEL Bench Dispenser holds Cards for production operators to code with both hands free. • 275 NEMA Markings and Colors in stock.

Write for Folder and FREE Sample Cards.



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Manufacturers of Self-Sticking Tape Products
Established 1914
809 No. Third, Milwaukee 3, Wisconsin
Factory: Chippewa Falls, Wisconsin

*Patents Pending

Thermoil-Granodine

THIS product is offered by **American Chemical Paint Co.**, Ambler, Pa., to create that heavy iron manganese phosphate coating on steel which retards rust and when oiled prevents excessive wear on friction surfaces. These features are of interest to manufacturers of pistons, piston rings, cam shafts, tools and a large variety of products.

* * *

THE oil-absorbing surface created by Thermoil-Granodine quickly burnishes and holds the lubricant, thus largely eliminating the dangers in the "breaking-in" period of high-speed machinery.

* * *

THERMOIL-GRANODINE makes an excellent finish for many hardware items and when used under paint provides unusually good rust protection; but, if a high lustre is desired, the Spray-Granodine is recommended. The latter produces a durable but smoother surface.

* * *

TECHNICAL Service Data Sheets will be sent on request.

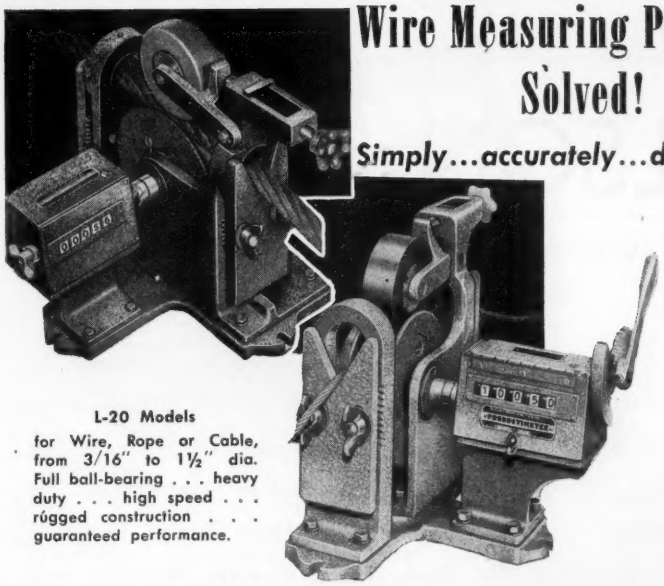
* * *

"Hydrocast" Cold Chamber Die Casting

AN instructive folder on a new design of full-hydraulic, fast operating Cold Chamber Die Casting Machines has been issued by **Hydropress, Inc.**, New York.

* * *

"HYDROCAST" is the Trade Mark of this line of Die Casting Machines, designed to cast the alloys of Copper, Aluminum, Magnesium, and Zinc, from 3 cu. in. to 300 cu. in. The principles of "Hydrocast" Die Casting are discussed in detail and diagrammed in three typical stages. Illustrations and close-up views describe the essentials of progressive die casting. A specification chart shows which model is best suited for given production jobs. Principal advantages and mechanical qualities are listed and should give ample information to the prospective user. Folder L-24-Y can be obtained from Hydropress, Inc., 570 Lexington Avenue, New York 22, N. Y.



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PRODUCTIMETER Wire Measuring Units offer you many different models to consider as you start tackling the problem of securing reliable count in various wire processing. They're adapted for measuring insulated cable, rope, chain, braid, bare copper cable, rough-surfaced conductor, greasy, oily wire . . . at speeds from 500 to 5000 feet per minute. Recommendations furnished gratis!

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The name "Fort Wayne" stands for the finest in quality and craftsmanship. Our customers can expect courteous and co-operative service on every order, and we strive to make each die so well that it will merit your good-will.

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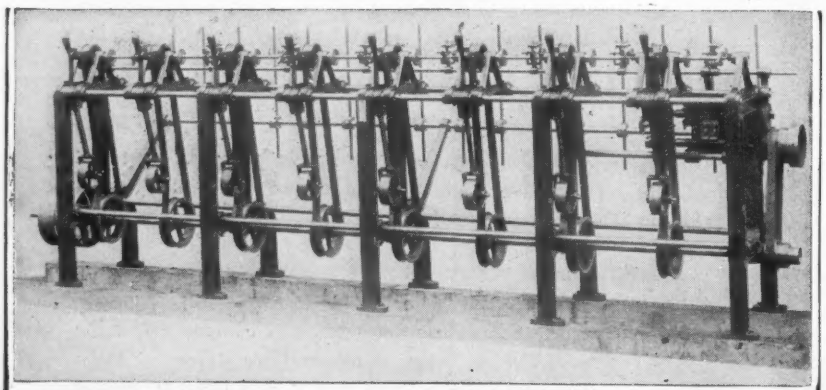

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WIRE SPOOLING MACHINES

Model illustrated takes spools up to 12" diameter. Floor space required: 19" x 10'; length can be varied to suit largest spool specified. Handles wire up to .050" diameter. Other models made to suit specific requirements.

EMORY SPOOLERS are built for years of continuous service. Precision made, durable, rugged, dependable.

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Booklet Describes Geiger-Counter Cemented Carbide Application

A NEW 4-page booklet (R1022) titled "Geiger-Counter Used in Powder Metallurgy" has been announced by **North American Philips Company, Inc.**, 100 East 42nd St., New York.

* * *

THE text material describes in detail the principles of operation of the Geiger-Counter X-ray Spectrometer. It also tells how the instrument is being used for control of cemented-carbide products.

* * *

DATA is presented to show how analysis time has been reduced from two days to 35 minutes in some instances. The three types of specimens used are explained. Charts show patterns for 100% tungsten carbide and for cemented carbide, respectively.

* * *

Acromark Offers New Ink for Marking Plastics, Rubber and Insulated Wire

ANNOUNCEMENT is made that new inks for successfully trademarking and imprinting Plastics, Rubber (both natural and synthetic) as well as for marking enamel, lacquer, plastic and rubber insulations on insulated wire and cable, have been developed by Acromark chemists.

* * *

IT is claimed by Acromark that the success of their chemists in developing these inks has been in that they have sought penetration rather than applying their efforts to simple coating, because in most instances a mark must remain a part of the material or product for the surface life of that product.

* * *

SAMPLES of these new inks and complete information upon them are available to manufacturing industry upon application. Also sample markings upon enquirers' actual materials will be prepared upon submission of materials or parts.

* * *

FOR complete information, write The Acromark Company, 423 Morrell St., Elizabeth 4, N. J.

Emulsion Technology Theoretical and Applied

THE application of emulsions in many industries and technical processes is discussed in this carefully compiled symposium. A new section has been added on the theory of emulsions in which all current conceptions have been compared and discussed in detail; the reader is given a clear picture of the viscosity, surface-film, surface-tension, phase-volume, solid particles, adsorption, hydration, oriented-adsorption, oriented-wedge and electo-kinetic theories and of their contribution to the explanation of the various phenomena of emulsification.

* * *

A SPECIAL feature of this new edition is a comprehensive list of emulsifying agents divided into the following categories: Anion Active Agents, Cation Active Agents, Non-Ionic Agents, and Miscellaneous Emulsifiers. This alphabetical list includes trade names, chemical composition, emulsion type, references, manufacturer and recommended uses of the emulsifying agents. It will be helpful to the beginner as well as to the specialist.

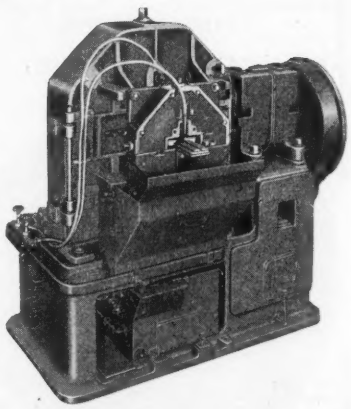
* * *

BESIDES this new information, the book includes authoritative data on methods of formulation of many practical, commercial emulsions in the fields of drugs, cosmetics, beverages, foods, polishes, waxes, coatings, paints, etc. It also gives valuable information concerning the patent literature on emulsions. This book is published by the Chemical Publishing Company, Inc., Brooklyn, N. Y. Price, $6.50.

* * *

Allegheny Ludlum Moves Offices to Pittsburgh

ON July 1, 1946, the executive offices of **Allegheny Ludlum Steel Corporation** were returned to the Henry W. Oliver Building, Pittsburgh, and are located on the twentieth floor. Expanded operations during the war and inability to secure additional office space necessitated their temporary location at Brackenridge.



All four sides are rolled simultaneously by "Standard" Turks Heads (adjustable draw plate) — the metal trade's established method of drawing rod to triangular, rectangular and special shapes such as keystone, diamond, star and channel forms — both plain and ornamental.

"Standard" Turks Heads, universal and plain types, are available in a wide range of capacities.

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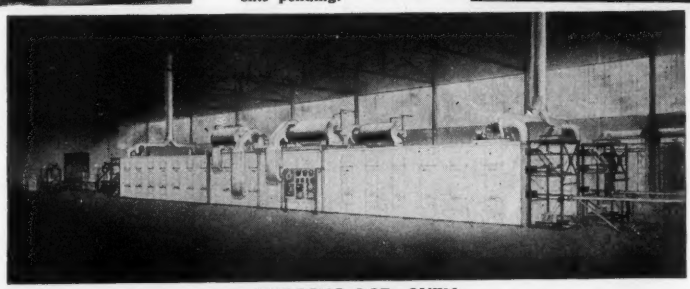
The fastest rod baker built! Saves up to 50% in time and fuel. Patented Blow-Off Feature removes moisture without bumping or agitating the coils. Patented and patents pending.



WELDING ROD OVEN

For drying coated welding rods. Uses the "Mayer" Recirculating Gas Fired Air Heater principle and Rod Transfer Systems (patents pending).

Growing interest in our type of equipment is evidenced by Carl-Mayer installations in such plants as: —

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Eaton Mfg. Co.
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Johnson & Nephew Ltd.
Page Steel & Wire Co.
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WRITE for BULLETIN No 241

THE CARL-MAYER CORPORATION

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All Steel
Reels

FOR SHIPPING
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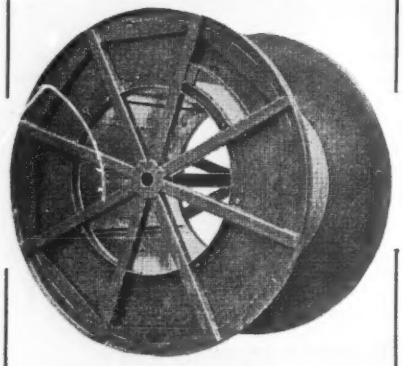
CABLE AND WIRE



Last Longer

Constructed of corrosion resisting materials, three to four times the life of a wooden reel is a reasonable expectancy.

Give Greater Protection

Smooth inner surfaces, much greater strength with the absence of all cutting or abrading projections — these protect not only the cable but the men handling it.

Save On Freight

Appreciably lighter than wooden reels — cost less to ship — a cumulative saving that more than offsets increased first cost.

Reduce Investment

The longer life of R. B. Hayward Steel reels reduces the investment in reel equipment.

Write for description of construction and prices.

R. B. Hayward Co.
1714 Sheffield Ave.,
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Direct and Indirect Air Heaters

THE J. O. Ross Engineering Corporation has just issued a new Bulletin 135-A which gives complete information concerning their various types of Direct and Indirect Air Heaters designed for use of oil or gas fuel. This 16-page bulletin is fully illustrated and includes charts, diagrams and tables covering such subjects as operating principle and construction, application of various types, nominal heating ratings and capacities. In fields such as finishing, heat treating, processing and drying where hot circulated air is used as the heating medium this bulletin should prove extremely helpful, and copies may be had by writing to J. O. Ross Engineering Corporation, 350 Madison Ave., New York 17, N. Y.

* * *

Demineralized Water in the Wire Mill

(*Continued from page 764*)

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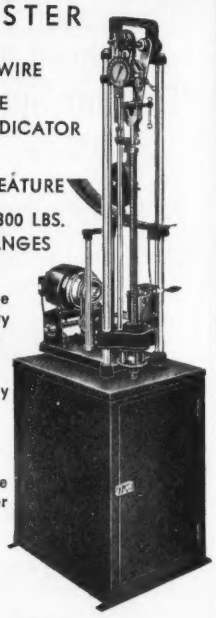
All Testers Can be Graduated in Either Metric or English System



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New French Dictionary

THE Chemical Publishing Company, 234 King Street, Brooklyn 31, New York, has just published a new English-French-French-English Technical Dictionary that should prove of great value to many of our readers.

* * *

IT is an accurate and up-to-date technical volume of interest to workers in every technical field and to those of our readers who are exporting or contemplating exporting to France or her colonies.

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KEEPING abreast of the newest accomplishments in the foreign field of industrial or scientific research is important and this book will help, because it covers terms and expressions not found in the ordinary dictionary, to get at correct meanings. Covers metallurgy, mining, electricity, chemistry, mechanics and sciences. The dictionary is priced at only $5.00.

* * *

Takes Over Tonawanda Plant

WESTERN ELECTRIC COMPANY has leased the Kenmore Plant of the Curtiss-Wright Corporation in the town of Tonawanda and the city of Buffalo, New York, according to C. G. Stoll, president of Western Electric. Comprising 760,000 square feet of floor space, the plant will manufacture switchboard cable and other telephone products and is expected to employ 3,000 people when in full production.

THE Company has taken possession of the plant and production on a limited basis should be under way before the end of the year. Expanded requirements of the Bell System for all types of telephone equipment make it necessary for Western Electric Company to acquire additional plant capacity. It is planned to transfer certain facilities from Chicago to Buffalo to permit the expansion of manufacture of other telephone products at the Company's Hawthorne Works.

WIRE CUTTING
MADE EASY

Hard wire*, spring wire, as well as soft wire, wire fabric, tie wire, fencing, etc. — easily and quickly cut with a porter tool. A standard model for average needs. Special models for special work.

Send for catalog showing all Porter models of wire cutters, bolt clippers, etc.
**(with center cut round edge jaws)*

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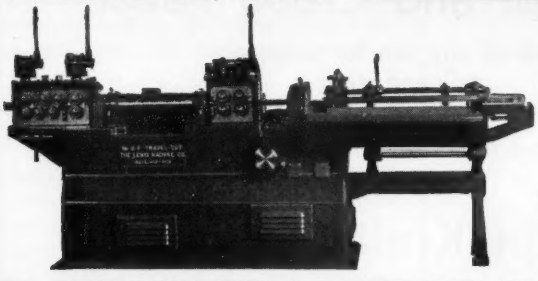
PORTER HKP CUTTERS

LEWIS TRAVELCUT WIRE STRAIGHTENING and CUTTING Machines



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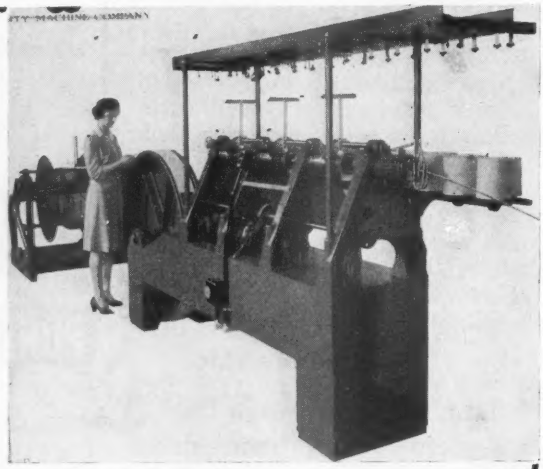

Knits two or three cotton coverings on bare wire up to #6 gauge —also flat or shaped, continuous-strip material, 1200 to 1500 feet per hour. Straightening rollers operate horizontally and vertically. Each head knits one cover. 36″ capstan take-off — separate haul-off reel stand, 40″ O.D., with traverse mechanism, 1000 lb. capacity.

Other advantages include: automatic electric stop motion on each yarn; improved knitting head and needle design; knits direct from large cones; quiet operation reduces operator fatigue.

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New Process Cuts Baking Time!

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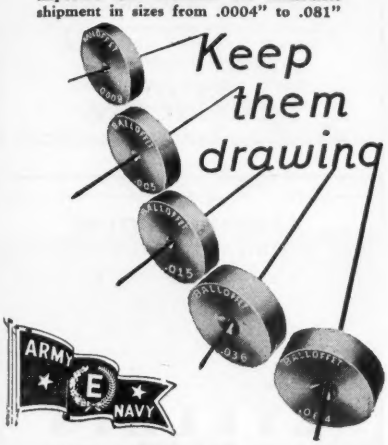

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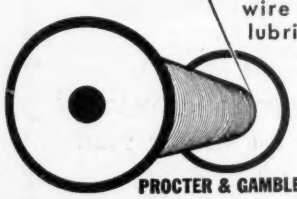
One of our representatives will be glad to discuss wire drawing lubricants with you.



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New Scientifically Prepared Diamond Compound for Fine Grinding, Lapping and Polishing

THE superior performance of diamond powders in many finishing operations is well known. Hyprez Diamond Compound is a new prepared abrasive containing only finely graded, pure diamond powders of best quality in a scientifically developed vehicle, combining this singular superiority with ease and full control of operation.

* * *

THE diamond particles are exactly graded to definite standard specifications and are evenly distributed and permanently suspended.

* * *

THIS Diamond Compound is an important cost saving factor on many jobs requiring high scratch-free finish and surface luster. It combines greatest speed of production with low unit cost of diamond abrasive. The compound is recommended for many finishing operations on metals, sintered carbides, sapphire and other hard materials. Die and mold work, gage and instrument production, industrial jewel and gem stone manufacture are some of the fields in which this compound is being introduced because of its ability to assure reliable duplication of "mirror" finishes at low over-all cost.

* * *

TO assure uniform and most economic performance on the job. this Diamond Compound is available in a large variety of grades, each readily identified by a distinguishing color. The compound is furnished in clear Pyrex cartridges which fit into syringe-type applicators. Full protection from dust, dirt and grit is assured, and metered amounts of the compound are easily applied to the work in a flat, economical ribbon. No special skill or special tools are required.

* * *

HYPREZ Diamond Compound is marketed by the Engis Equipment Company, 431 South Dearborn Street, Chicago 5, Illinois, and the Sapphire Products Division of the Elgin National Watch Company, 932 Benton Street, Aurora, Illinois.

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.00045	.0011
.0005	.0012
.00055	.0013
.0006	.0014
.00065	.0015
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Aluminum Wire Fabrication

(*Continued from page 767*)

ately 24,000 to 30,000 lbs. per sq. in., depending upon the final size. The steel core wire is galvanized and has a tensile strength of approximately 190,000 lbs. per sq. in. Most of the strength of the conductor comes from the steel core. The aluminum contributes its proportional share of the strength but its main purpose is to carry the current. Besides use of E.C. in A.C.-S.R., considerable interest has been shown in the use of this wire for house and aircraft wiring, either solid or stranded without the steel core.

* * *

THE standard aluminum wire for insect screen cloth is Alclad 56S having a core of an aluminum-magnesium alloy (56S) and a coating of an aluminum-magnesium-silicon alloy which comprises roughly one-quarter of the wire area and which is alloyed to the core through the method of fabrication. The excellent corrosion resistance of the high strength 56S core alloy, which in the hard drawn temper uncoated reaches a tensile strength of as high at 65,000 lbs. per sq. in., is greatly increased, especially in marine atmospheres by the presence of the coating alloy for electrolytic protection of the core. Alclad 56S wire is drawn in a manner similar to other aluminum alloy wires and is used in the hard drawn temper. Aluminum screen cloth is becoming increasingly popular because of its pleasing color, its excellent resistance to corrosion as compared with other metal cloth, the fact that its corrosion products are colorless and do not stain window frames and other portions of buildings and homes, and last but not least to its favorable price position.

* * *

PRESENT indications are that, within the near future, numerous other applications for aluminum wire will be found which will cause the entry of other concerns into the aluminum wire drawing field.

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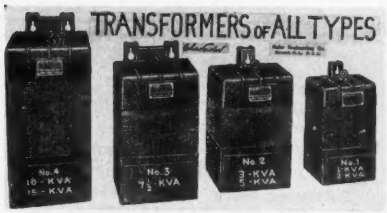

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Oakite Products, Inc., New York, N. Y.
Shell Oil Co., Inc., New York, N. Y.

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Oakite Products, Inc., New York, N. Y.
Shell Oil Co., New York, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

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Magnus Chemical Co., Garwood, N. J.
Miller, R. H. Co., Inc., Homer, N. Y.
Oakite Products, Inc., New York, N. Y.
Potter, Neil C., Newark, N. J.
Shell Oil Co., Inc., New York, N. Y.
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Wayne Wire Die Co., Hillside, N. J.

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Wayne Wire Die Co., Hillside, N. J.

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New England Wire Die Co., Worcester, Mass.
Rusch Wire Die Corp., Croton-on-the-Hudson, N.Y.
Vianney Wire Die Wks., New York, N. Y.
Wayne Wire Die Co., Hillside, N. J.

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Carboloy Co., Detroit, Mich.
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Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corp., Youngstown, O.
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New Eng. Wire Die Co., Worcester, Mass.
Rusch Wire Die Corp., Croton-on-the-Hudson, N.Y.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Wks., New York, N. Y.
Wayne Wire Die Co., Hillside, N. J.
Willey's Carbide Tool Co., Detroit, Mich.

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Balloffet Dies & Nozzle Co., Inc., Guttenberg, N.J.
Carboloy Co., Inc., Detroit, Mich.
Firth Sterling Steel Co., McKeesport, Pa.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corp., Youngstown, O.
Michigan Wire Die Works, Detroit, Mich.
Rusch Wire Die Corp., New York, N. Y.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Wks., New York, N. Y.
Willey's Carbide Tool Co., Detroit, Mich.

DIES—Tantalum Carbide
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N.J.
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corp., Youngstown, O.
Rusch Wire Die Corp., Croton-on-the-Hudson, N.Y.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Wks., New York, N. Y.
Willey's Carbide Tool Co., Detroit, Mich.

DIES—Tungsten Carbide
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N.J.
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corp., Youngstown, O.
Michigan Wire Die Co., Detroit, Mich.
Rusch Wire Die Corp., Croton-on-the-Hudson, N.Y.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Wks., New York, N. Y.
Wayne Wire Die Co., Hillside, N. J.
Willey's Carbide Tool Co., Detroit, Mich.

DIRECT ELECTRIC RESISTANCE HEATING—
Trauwood Engr. Co., Cleveland, Ohio.

DRAW BENCHES—
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E J. Fdry. & Mach. Co., Trenton, N. J.
Standard Machinery Co, Providence, R I.
Vaughn Machinery Co., Cuyahoga Falls, O.

DRUMS—Flange Steel
Hubbard Spool Company, Chicago, Ill.
Stevens Metal Products Co., Niles, Ohio.

DRUMS—Vulcanizing
Mossberg Pressed Steel Corp., Attleboro, Mass.

DRYING & PRE-HEATING ROOMS—
Carl-Mayer Corp., Cleveland, Ohio.
Industrial Ovens, Inc., Cleveland, Ohio.

DRYING EQUIPMENT—
Carl-Mayer Corp., The, Cleveland, Ohio.
Ross, J. O., Engineering Corp., New York, N. Y.

ENGINEERS—Consulting Wire Mill
Lewis, Kenneth B., Worcester, Mass
Syer, C. Raymond, Westport, Conn.
Wiel, L. D., New York, N. Y.

EQUIPMENT—Insulation Testing
Davis, R. L., Elec. Co, Wallingford, Conn.
Entwistle, James L., Co., Pawtucket, R. I

WHERE TO BUY, Continued

EYELETS—Brass or Zinc
Platt Bros., & Co., The, Waterbury, Conn.

FLASH BAKERS—
Morrison Engineering Corp., Cleveland, Ohio.

FLUXES—Soldering
American Chemical Paint Co., Ambler, Pa.

FOAM PRODUCING COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.
Parkin, Wm. M. Co., Pittsburgh, Pa.

FRICTION PAY-OFF STANDS—
Industrial Ovens, Inc., Cleveland, Ohio.

FURNACES—Annealing
Ajax Electric Co., Inc., Philadelphia, Pa.
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, Ohio.
Furnace Engineers, Inc., Pittsburgh, Pa.
Hayes C. I., Providence, R. I.
Morrison Engineering Corp., Cleveland, Ohio.
Salem Engineering Co,. Salem, Ohio
Surface Combustion Corp., Toledo, Ohio.
Trauwood Engr. Co., Cleveland, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

FURNACES—Automatic
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, Ohio.
Morrison Engineering Corp., Cleveland, Ohio.
Surface Combustion Corp., Toledo, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

FURNACES—Brazing
Electric Furnace Co., Salem, Ohio.
Firth-Sterling Steel Co., McKeesport, Pa.

FURNACES—Bright Annealing
Electric Furnace Co., Salem, Ohio.
Furnace Engineers, Inc., Pittsburgh, Pa.
Salem Engineering Co., Salem, Ohio.
Surface Combustion Corp., Toledo, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

FURNACES—Electric
Eisler Engineering Co., Newark, N. J.
Electric Furnace Co., Salem, Ohio.
Hayes C. I., Providence, R. I.
Salem Engineering Co., Salem, Ohio.
Surface Combustion Corp., Toledo, Ohio.

FURNACES—Galvanizing Equipment
Electric Furnace Co., Salem, Ohio.
Furnace Engineers, Inc., Pittsburgh, Pa.
Meaker Co., The, Chicago, Ill.
Sleeper & Hartley, Inc., Worcester, Mass.
Surface Combustion Corp., Toledo, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

FURNACES—Hard'ing & Temp'ing
Ajax Electric Co., Inc., Philadelphia, Pa.
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, Ohio.
Salem Engineering Co., Salem, Ohio.
Surface Combustion Corp., Toledo, Ohio.
Trauwood Engr. Co., The, Cleveland Ohio.

FURNACES—Lead Melting
Electric Furnace Co., Salem, Ohio.
Furnace Engineers, Inc., Pittsburgh, Pa.
Robertson, John, Co., Brooklyn, N. Y.
Surface Combustion Corp., Toledo, Ohio.

FURNACES—Non-Oxidizing
Ajax Electric Co., Inc., Philadelphia, Pa.
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, Ohio.
Furnace Engineers, Inc., Pittsburgh, Pa.
Morrison Engineering Corp., Cleveland, Ohio.
Salem Engineering Co., Salem, Ohio.
Surface Combustion Corp., Toledo, Ohio.

FURNACES—Normalizing
Ajax Electric Co., Inc., Philadelphia, Pa.
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, Ohio.
Furnace Engineers, Inc., Pittsburgh, Pa.
Morrison Engineering Corp., Cleveland, Ohio.
Salem Engineering Co., Salem, Ohio.
Surface Combustion Corp., Toledo, Ohio.

FURNACES—Pot (Oil, Gas, Electric)
Ajax Electric Co., Inc., Philadelphia, Pa.

FURNACES—Salth Bath
Ajax Electric Co., Inc., Philadelphia, Pa.
Electric Furnace Co., Salem, Ohio.
Surface Combustion Corporation, Toledo, O.

FURNACES—Wire, Strip & Sheet
Carl-Mayer Corp., The, Cleveland, Ohio.
Eisler Engineering Co., Newark, N. J.
Electric Furnace Co., Salem, Ohio.
Furnace Engineers, Inc., Pittsburgh, Pa.
Morrison Engineering Corp., Cleveland, Ohio.
Salem Engineering Co., Salem, Ohio.
Surface Combustion Corporation, Toledo, O.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

GALVANIZING EQUIPMENT—
Hanson, Van Winkle, Munning Co., Matawan, N. J.

GALVANIZING FLUXES
Hanson, Van Winkle, Munning Co., Matawan, N. J.

GALVANIZING KETTLES—
National Annealing Box Co., Washington, Penna.

GOVERNMENT SURPLUS MATERIALS
War Assets Corporation, New York, N Y.

GRINDERS—Roll
Norton Co., Worcester, Mass.

HOISTS—Electric Travelling
Cleveland Tramrail Div. of Cleveland.
Crane & Engineering Co., Wickliffe, Ohio.

INHIBITORS—Pickling
American Chemical Paint Co., Ambler, Pa.
Oakite Products, Inc., New York, N. Y.
Parkin, Wm. M. Co., Pittsburgh, Pa.

INSULATING LACQUERING SYSTEMS—Continuous
Industrial Ovens, Inc., Cleveland, Ohio.

INSULATING MATERIALS—
Ansonia Electric Div., of Noma Electric Corp., Ansonia, Conn.
Crepe-Kraft Co., Newark, N. J
Du Pont de Nemours E. I. Co., Wilmington, Del.
General Electric Co., Schenectady, N. Y.
Owens Corning Fiberglas Corp., Toledo, O.
Standard Varnish Wks., Staten Island, N. Y.

KETTLES—Galvanizing, Annealing, Tinning, etc.
National Annealing Box Co., Washington, Penna.

LATHES—Die Reaming
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Morgan Construction Co., Worcester, Mass.
Roos, H. & G., Tool & Mfg. Co., Montclair, N.J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Machine Co., Waterbury, Conn.

LIME—
Warner Co., Philadelphia and Bellefonte, Pa.

LININGS—Acid and Alkali Proof
Ceilcote Co., The, Cleveland, Ohio.
Haveg Corp., Newark, Del.
Heil Process Equipment Corp., Cleveland, Ohio.

LUBRICANTS—For Metal Cutting, Stamping and Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Ironsides Co., The, Columbus, Ohio.
Magnus Chemical Co., Garwood, N. J.
Miller, R. H., Co., Inc., Homer, N. Y.
Oakite Products, Inc., New York, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

LUBRICANTS—Wire Drawing
Apex Alkali Products Co., Phila., Pa.
Bick, Hans C., Inc., Reading, Pa.
Ironsides Co., The, Columbus, Ohio.
Magnus Chemical Co., Garwood, N. J.
Miller, R. H., Co., Homer, N. Y.
Oakite Products, Inc., New York, N. Y.
Potter, Neil C., Newark, N. J.
Standard Industrial Compounds Co., Chicago, Ill.

MACHINERY—Armoring (Cable, Wire Hose)
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Braiding
Fidelity Machine Co., Philadelphia, Pa.
Mossberg Pressed Steel Corp., Attleboro, Mass.
New England Butt Co., Providence, R. I.
Wire & Textile Mach'y, Inc., Pawtucket, R. I.

MACHINERY—Brazing
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Bolts & Rivets
National Machinery Co., Tiffin, Ohio.

MACHINERY—Bunching
American Insulating Mach'y Co., Phila, Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Bundling, Scrap
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Cable, Electric
American Insulating Mach'y Co., Phila, Pa.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Cable Reel Boring
Root, B. M. Co., York, Pa.

MACHINERY—Chain Making
Nilson, A. H. Machine Co., The, Bridgeport, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Cable, Rope Closing
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Coil Winding
Entwistle, Jas. L. Co., Pawtucket, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Coilers
Broden Construction Co., Cleveland, Ohio.
Eisler Engineering Co., Newark, N. J.
Entwistle, Jas. L. Co., Pawtucket, R. I.
Morgan Construction Co., Worcester, Mass.
New England Butt Co., Providence, R. I.
Ruesch, H. J. Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Waterbury Farrel Fdry. & Mach. Co., Waterbury, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Cold Heading
Ajax Manufacturing Co., Cleveland, O.
National Machinery Co., Tiffin, O.

MACHINERY—Copper Wire Drawing and Rolling
American Insulating Mach'y Co., Phila, Pa.
Ruesch, H. J., Machine Co., Newark, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Covering Wire
American Insulating Mach'y Co., Phila, Pa.
Royle, John & Sons, Paterson, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Cutting
Ajax Manufacturing Co., Cleveland, Ohio.
Broden Construction Co., Cleveland, Ohio.
Eisler Engineering Co., Newark, N. J.
Hallden Machine Co., The, Thomaston, Conn.
Lewis Machine Co., The, Cleveland, Ohio.
Moslo Machinery Inc., Cleveland, Ohio.
National Mach'y Exch., (Used), New York, N.Y.
Nilson, A. H. Machine Co., Bridgeport, Conn.
Porter, H. K. Inc., Everett, Mass.
Shuster, F. B. Mfg., Co., New Haven, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Die Making
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Roos, H. & G., Tool & Mfg. Co. Montclair, N.J.
Wayne Wire Die Co., Hillside, N. J.

MACHINERY—Draw Benches
Ajax Manufacturing Co., Cleveland, O.
Broden Construction Co., Cleveland, O.
Morgan Construction Co., Worcester, Mass.
Ruesch, H. J., Machine Co., Newark, N. J.
Standard Machinery Co., Providence, R. I.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

WHERE TO BUY, Continued

MACHINERY—Edging
Broden Construction Co., Cleveland, Ohio.
Standard Machinery Co., Providence, R. I.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Enameling
American Insulating Mach'y Co., Phila., Pa.
Industrial Ovens, Inc., Cleveland, O.
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Extruding
Robertson John, Co., Brooklyn, N. Y.
Royle, John, & Sons, Paterson, N. J.

MACHINERY—Fence
Broden Construction Co., Cleveland, Ohio.
Glader, Wm. Machine Works, Chicago, Ill.

MACHINERY—Filament Coil Winding
Eisler Engineering Co., Newark, N. J.

MACHINERY—Flat Wire
Broden Construction Co., Cleveland, Ohio.
Ruesch, H. J., Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Forming
Eisler Engineering Co., Newark, N. J.
National Mach'y Exch. (Used), New York, N. Y.
Nilson, A. H. Machine Co., Bridgeport, Conn.
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.
Seifert, E. R., Inc., Syracuse, N. Y.
Sleeper & Hartley, Inc, Worcester, Mass.
Standard Machinery Co., Providence, R. I.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Galvanizing
Wilson, Lee, Engr. Co., Cleveland, Ohio.

MACHINERY—Galvanizing Wire
Broden Construction Co., Cleveland, Ohio.
Meaker Co., The, Chicago, Ill.
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

MACHINERY—Gang Winders
Entwistle, Jas. L. Co., Pawtucket, R. I.
Fidelity Machine Co., Philadelphia, Pa.
Ruesch, H. J., Machine Co., Newark, N. J.
Syncro Machine Co, Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Grinding
Norton Co., Worcester, Mass.

MACHINERY—Insulating
American Insulating Mach'y Co., Phila, Pa.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Royle, John & Sons, Paterson, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Knitting
Fidelity Machine Co., Philadelphia, Pa.

MACHINERY—Lead Encasing Presses, etc.
Robertson, John Co., Brooklyn, N. Y.

MACHINERY—Lead Stripping
Robertson, John Co., Brooklyn, N. Y.

MACHINERY—Lock Washer
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Magnet Wire
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Material Handling
Cleveland Tramrail, Div. of the Cleveland. Crane & Engineering Co., Wickliffe, O.

MACHINERY—Measuring Wire & Cable
Durant Mfg. Co., Milwaukee, Wis.
Entwistle, Jas. L. Co., Pawtucket, R. I.
New England Butt Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Nail and Tack
Broden Construction Co., Cleveland, Ohio.
Glader, Wm. Machine Works, Chicago, Ill.
National Mach'y Exch. (Used), New York, N.Y.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Panning
American Insulating Mach'y Co., Phila., Pa.
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Pointing
Broden Construction Co., Cleveland, Ohio.
Morgan Construction Co., Worcester, Mass.
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E. J., Fdry. & Mach., Co., Trenton, N.J.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Foundry & Machinery Co., Waterbury, Conn.

MACHINERY—Quill Winding
Fidelity Machine Co., Philadelphia, Pa.

MACHINERY—Rod Mill
Broden Construction Co., Cleveland, Ohio.
Morgan Construction Co., Worcester, Mass.
Ruesch, H. J., Machine Co., Newark, N. J.

MACHINERY—Rolling Mill
Broden Construction Co., Cleveland, Ohio.
Morgan Construction Co., Worcester, Mass.
National Mach'y Exch. (Used), New York, N.Y.
Ruesch, H. J., Machine Co., Newark, N. J.
Standard Machinery Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Waterbury-Farrel Foundry & Machinery Co., Waterbury, Conn.

MACHINERY—Rubber for Insulating Wire
Royle, John & Sons, Paterson, N. J.

MACHINERY—Rubber Tubing and Straining
New England Butt Co., Providence, R. I.
Royle, John & Sons, Paterson, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Screw Wire
National Mach'y Exch. (Used), New York, N. Y.
Sleeper & Hartley, Inc, Worcester, Mass.

MACHINERY—Special
American Insulating Mach'y Co., Phila, Pa.
Broden Construction Co., Cleveland, Ohio.
Emory, Robert J., Co., Newark, N. J.
Entwistle, Jas. L. Co., Pawtucket, R. I.
New England Butt Co., Providence, R. I.
Ruesch, H. J., Machine Co., Newark, N. J
Scudder, E. J., Fdry. & Mach., Co., Trenton, N.J.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I. (Special Designs).
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Spooling
American Insulating Mach'y Co., Phila., Pa.
Eisler Engineering Co., Newark, N. J.
Emory, Robert J., Co., Newark, N. J.
Entwistle. Jas. L. Co., Pawtucket. R. I.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Foundry & Machinery Co., Waterbury, Conn.
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc., Pawtucket, R. I.

MACHINERY—Spring Making
National Mach'y Exch. (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Staple
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Straightening
Ajax Manufacturing Co., Cleveland, O.
Broden Construction Co., Cleveland, Ohio.
Hallden Machine Co., Thomaston, Conn.
Lewis Machine Co., The, Cleveland, Ohio.
Moslo Machinery Co., Cleveland, Ohio.
National Mach'y Exch. (Used), New York, N. Y.
Nilson, A. H. Machine Co., Bridgeport, Conn.
Ruesch, H. J., Machine Co., Newark, N. J
Shuster, F. B., Mfg. Co., New Haven, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Stranding
Hughesville Machine & Tool Co., Hughesville, Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Strip Steel
Broden Construction Co., Cleveland, Ohio.
Ruesch, H. J., Machine Co., Newark, N. J.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Swaging
National Mach'y Exch. (Used), New York, N. Y.
Ruesch, H. J., Machine Co., Newark, N. J
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N .J.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Taping
American Insulating Mach'y Co., Phila., Pa.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N .J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Testing
Amthor Testing Instrument Co., Brooklyn, N. Y.

MACHINERY—Testing Equipment—Sparkers
Davis, R. L., Elec. Co., Wallingford, Conn.
Dillon W. C. & Co., Inc., Chicago, Ill.
Entwistle, Jas. L., Pawtucket, R. I.

MACHINERY—Testing Spring
Standard Machinery Co., Providence, R. I.

MACHINERY—Tinsel Rolling Mills
American Insulating Mach'y Co., Phila., Pa.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Trolley Wire
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Tube Mill
Ruesch, H. J., Machine Co., Newark, N. J.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Welding Wire
Eisler Engineering Co., Newark, N. J.
Micro Products Co., Chicago, Ill.
Sciaky Bros., Inc., Chicago, Ill.
Moslo Machinery Co., Cleveland, Ohio.
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Winding
American Insulating Mach'y Co., Phila., Pa.
Eisler Engineering Co., Newark, N. J.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Mill Supply Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wind-up (Constant Tension, Variable Speed)
Industrial Ovens, Inc., Cleveland, O.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wire Bending
Eisler Engineering Co., Newark, N. J.
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.

MACHINERY—Wire Drawing
Ajax Manufacturing Co., Cleveland, O.
American Insulating Mach'y Co., Phila, Pa.
Broden Construction Co., Cleveland, Ohio.
Eisler Engineering Co., Newark, N. J.
Morgan Construction Co., Worcester, Mass.
National Mach'y Exch. (Used), New York, N. Y.
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E. J., Fdry. & Mach., Co., Trenton, N.J.
Sleeper & Hartley, Inc, Worcester, Mass.
Standard Machinery Co., Providence, R. I.
Standard Mill Supply Co., Providence, R .I.
Syncro Machine Co., Perth Amboy, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Wire Rope
New England Butt Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J .

MACHINERY—Wire Tinning
American Insulating Mach'y Co., Phila, Pa.
New England Butt Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.

WHERE TO BUY, Continued

MACHINERY—Wood Screw
National Mach'y Exch. (Used), New York, N. Y.

MATERIAL HANDLING EQUIPMENT
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.

MILLS—Tandem Rolling and Edging
Standard Machinery Co., Providence, R. I.
Torrington Mfg. Co., Torrington, Conn.

NAILS—Wire
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Keystone Steel & Wire Co., Peoria, Ill.

NICKEL SILVER AND PHOSPHOR BRONZE—Rod, Wire and Strip
Hudson Wire Co., Ossining, N. Y.

OILS—Wire Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Miller, R. H., Co., Inc., Homer, N. Y.
Oakite Products, Inc., New York, N. Y.
Procter & Gamble, Cincinnati, Ohio.
Shell Oil Co., New York, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

OVENS—Cable Lacquering
American Insulating Mach'y Co., Phila., Pa.
Industrial Ovens, Inc., Cleveland, Ohio.

OVENS—Dehydrogenizing
Carl-Mayer Corp., The, Cleveland, Ohio.
Industrial Ovens, Inc., Cleveland, Ohio.

OVENS—Industrial
Carl-Mayer Corp., The, Cleveland, Ohio.
Industrial Ovens, Inc., Cleveland, Ohio.
Ross, J. O., Engr. Corp., New York, N. Y.

OVENS—Welding Rod Coating
Carl-Mayer Corp., The, Cleveland, Ohio.
Industrial Ovens, Inc., Cleveland, Ohio.
Moslo Machinery Co., Cleveland, Ohio.
Ross, J. O., Engr. Corp., New York, N. Y.

PAINTS—Heat Resisting
American Chemical Paint Co., Ambler, Pa.

PAINTS—Marine
American Chemical Paint Co., Ambler, Pa.

PAINTS—Structural Steel
American Chemical Paint Co., Ambler, Pa.

PANS—Lead and Spelter
National Annealing Box Co., Washington, Penna.

PANS—Vulcanizing
Mossberg Pressed Steel Corp., Attleboro, Mass.

PAPER—Creped Wrapping
Crepe-Kraft Co., Newark, N. J.

PAPER—For Coil Wrapping and Corrosion Prevention
Crepe-Kraft Co., Newark, N. J.

PAPER TESTERS—
Scott Testers, Inc., Providence, R. I.

PATENT ATTORNEYS—
Lancaster, Allwine and Rommel, Washington, D.C.

PICKLING COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Phila., Pa.
Oakite Products, Inc., New York, N. Y.
Parkin, Wm. M., Co., Pittsburgh, Pa.

PICKLING TANK LININGS—
Ceilcote Co., The, Cleveland, Ohio.
Haveg Corp., Newark, Del.
Heil Process Equipment Corp., Cleveland, Ohio.
Sauereisen Cements Co., Pittsburgh, Pa.

PIPES & FITTINGS—Acid Resistant
Ceilcote, Co., The, Cleveland, Ohio.
Haveg Corp., Newark, Del.
Heil Process Equipment Corp., Cleveland, Ohio.

PLASTIC TESTERS—
Scott Testers, Inc., Providence, R. I.

POTS—Lacquer
Industrial Ovens, Inc., Cleveland, Ohio.

POTS—Lead Melting
National Annealing Box Co, Washington, Pa.
Robertson, John, Co., Brooklyn, N. Y.

POWDER—Wire Drawing
Apex Alkali Products Co,. Phila, Pa.
Magnus Chemical Co., Garwood, N. J.
Miller, R. H., Co., Inc., Homer, N. Y
Potter, Neil C., Newark, N. J.
Standard Industrial Compounds Co., Chicago, Ill.

PRESSES—Hydraulic and Mechanical
Robertson, John, Co., Brooklyn, N. Y.
Standard Machinery Co., Providence, R. I. (Mechanical Only)

PRESSES—Lead
Robertson, John, Co., Brooklyn, N. Y.

PRESSURE VESSELS—
National Annealing Box Co., Washington, Penna.

PULLERS—Wire
Scudder, E. J., Fdry. & Mach., Co., Trenton, N.J.
Sleeper & Hartley, Inc, Worcester, Mass.

PUMPS—Hydraulic
Robertson, John, Co., Brooklyn, N. Y.

REEL AND TENSION STAND—
Fidelity Machine Co., Philadelphia, Pa.
Industrial Ovens, Inc., Cleveland, Ohio.
Moslo Machinery Co., Cleveland, Ohio.
Sleeper & Hartley, Inc, Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

REEL CRUTCHES—
Watson Machine Co., Paterson, N. J.

REELS—Annealing and Stranding
Apco Mossberg Co., Attleboro, Mass.
Hayward, R. B. Co., Chicago, Ill.
Hubbard Spool Company, Chicago, Ill.
Moslo Machinery Co., Cleveland, Ohio.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, Ohio.

REELS—Collapsible
Entwistle, Jas. L. Co., Pawtucket, R. I.

REELS—Steel
Apco Mossberg Co., Attleboro, Mass.
Hayward, R. B. Co., Chicago, Ill.
Hubbard Spool Company, Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, Ohio.

REELS AND SPOOLS—Shipping and Shop
Apco Mossberg Co., Attleboro, Mass.
Bridge Mfg., Co., Inc., The, Hazardville, Conn.
Hayward, R. B. Co., Chicago, Ill.
Hubbard Spool Company, Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, Ohio.

REELS—Takeoff
Apco Mossberg Co., Attleboro, Mass.
Hayward, R. B. Co., Chicago, Ill.
Hubbard Spool Company, Chicago, Ill.
Moslo Machinery Co., Cleveland, Ohio.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Shuster, F. B., Mfg. Co., New Haven, Conn.
Stevens Metal Products Co., Niles, Ohio.

REELS—Vulcanizing & Impregnating
Apco Mossberg Co., Attleboro, Mass.
Hayward, R. B. Co., Chicago, Ill.
Hubbard Spool Company, Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, Ohio.

REELS—Wire Drawing
Apco Mossberg Co., Attleboro, Mass.
Hayward, R. B. Co., Chicago, Ill.
Hubbard Spool Company, Chicago, Ill.
Moslo Machinery Co., Cleveland, Ohio.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, Ohio.

REELS—Wooden
Bridge Mfg Co., Inc., The, Hazardville, Conn.

REFRACTORIES—High Temperature
Norton Company, Worcester, Mass.

ROD BAKERS—
Carl-Mayer Corp., The, Cleveland, Ohio.
Morrison Engineering Corp., Cleveland, O.
Moslo Machinery Co., Cleveland, Ohio.
Ross, J. O., Engineering Corp., New York, N.Y.

RODS—Nickel Alloy
International Nickel Co., Inc., New York, N. Y.

RODS—Stainless Steel
Rustless Iron & Steel Div., American Rolling Mill Co., Baltimore, Md.

RODS—Wire—Non-Ferrous
American Brass Co., The, Waterbury, Conn.
Hudson Wire Co., Ossining, N. Y.
Platt Bros. & Co., The, Waterbury, Conn.

RODS—Wire—Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Indiana.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Roebling's John A., Sons Co., Trenton, N. J.
Youngstown Sheet & Tube Co., Youngstown, O.

ROLL STRAIGHTENERS—
Moslo Machinery Co., Cleveland, Ohio.

ROPE—Wire
Bethlehem Steel Co., Bethlehem, Pa.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Roebling's, John A., Sons Co., Trenton, N. J.

RUBBER AND RUBBER COMPRESSION TESTERS—
Scott Testers, Inc., Providence, R. I.

RUST PROOF COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Oakite Products, Inc., New York, N. Y.

RUST REMOVING COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Heil Process Equipment Corp., Cleveland, Ohio.
Standard Industrial Compounds Co., Chicago, Ill.

SATURATION SYSTEMS
Industrial Ovens, Inc., Cleveland, Ohio.
Watson Machine Co., Paterson, N. J.

SHEARS—
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.

SHEET—Steel
Continental Steel Corp., Kokomo, Ind.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Youngstown Sheet & Tube Co., Youngstown, O.

SOAPS—Industrial and Wire Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Bick, Hans C., Inc., Reading, Pa.
Magnus Chemical Co., Garwood, N. J.
Miller, R. H. Co., Inc., Homer, N. Y.
Potter, Neil C., Newark, N. J.
Procter & Gamble, Cincinnati, Ohio.
Shell Oil Co., Inc., New York, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

SOLVENT RESIN SYSTEMS—Experimental
Industrial Ovens, Inc., Cleveland, Ohio.

SPOOLS—Annealing and Wire Drawing
Apco Mossberg Co., Attleboro, Mass.
Hayward, R. B., Co., Chicago, Ill.
Howsam Spool Company, Aurora, Ill.
Hubbard Spool Company, Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, Ohio.

SPOOLS—Shipping and Shop
Apco Mossberg Co., Attleboro, Mass.
Hayward, R. B. Co., Chicago, Ill.
Howsam Spool Company, Aurora, Ill.
Hubbard Spool Company,. Chicago, Ill
Mossberg Pressed Steel Corp., Attleboro, Mass
Stevens Metal Products Co., Niles, Ohio.

SPOOLS—Steel
Apco Mossberg Co., Attleboro, Mass.
Hayward, R. B. Co., Chicago, Ill.
Hubbard Spool Company, Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, Ohio.

SPRINGS—Tools for Forming
State Machine Tool Co., Hartford, Conn.

STAMPINGS—Steel
Hubbard Spool Company, Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.

STRAND, PROCESS—
Pennsylvania Wire Laboratories, Herndon, Pa.

STRIP—Brass and Non-Ferrous
Hudson Wire Co., Ossining, N. Y.

STRIP—Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Firth-Sterling Steel Co., McKeesport, Pa.
Jones & Laughlin Steel Corp., Pittsburgh, Pa
Roebling's, John A., Sons Co., Trenton, N. J.
Seneca Wire & Mfg. Co., The, Fostoria Ohio.
Youngstown Sheet & Tube Co., Youngstown, O.

WHERE TO BUY, Continued

SWIFTS—Take-off
Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Watson Machine Co., Paterson, N. J.

TANK LININGS—Brick
Ceilcote Co., The, Cleveland, Ohio.
Keagler Brick Co., Steubenville, Ohio.
Knight, Maurice A., Akron, Ohio.
Nukem Products Corp., Buffalo, N. Y.

TANK—Compound
Haveg Corp., Newark, Del.
Watson Machine Co., Paterson, N. J.

TANKS—Pickling
Ceilcote Co., The, Cleveland, Ohio.
Haveg Corp., Newark, Del.
Heil Process Equipment Corp., Cleveland, Ohio.
Knight, Maurice A., Akron, Ohio.
Nukem Products Corp., Buffalo, N. Y.
Sauereisen Cements Co., Pittsburgh, Pa.

TANKS—Steel
Mossberg Pressed Steel Corp., Attleboro, Mass.
National Annealing Box Co., Washington, Penna.

TAPES—Self Sticking
Brady, W. H. Co., Milwaukee, Wis.

TESTING INSTRUMENTS—
Amthor Testing Instrument Co., Brooklyn, N.Y.
Davis, R. L., Elec. Co., Wallingford, Conn.

TOOLS—Spring Forming
State Machine Tool Co., Hartford, Conn.

TOOLS—Wire Cutting
Porter H. K., Inc., Everett, Mass.

TRAMRAIL SYSTEMS—
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.

TRAVERSES—For Reels
Entwistle, James L. Co., Pawtucket, R. I.
Hubbard Spool Company, Chicago, Ill.
Stevens Metal Products Co., Niles, Ohio.

TRAVERSE MECHANISMS—
Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Corp., Attleboro, Mass.
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

TREADS—Safety
Norton Co, Worcester, Mass.

TUBE BENDERS AND FORMERS—
Ruesch, H. J. Machine Co., Newark, N. J.

TURKS HEADS—Friction and Power
Standard Machinery Co., Providence, R. I.

VALVES AND FITTINGS—Acid Resistant
Haveg Corp., Newark, Del.

VARNISHES—For Insulation
Standard Varnish Wks., Staten Island, N. Y.

VULCANIZERS—
Knight, Maurice A., Akron, Ohio.
Watson Machine Co., Paterson, N. J.

VULCANIZING PANS—
American Insulating Mach'y Co., Phila., Pa
Mossberg Pressed Steel Corp., Attleboro, Mass.

WELDERS—Spot and Butt
Eisler Engineering Co., Newark, N. J.
Micro Products Co., Chicago, Ill.
Moslo Machinery Co., Cleveland, Ohio.
Sciaky Bros., Co., Chicago, Ill.

WIND-UP AND UNWIND SYSTEMS—Continuous
American Insulating Mach'y Co., Phila, Pa.
Davis, R. L., Electric Co., Wallingford, Conn.
Entwistle, James L. Co., Pawtucket, R. I.
Industrial Ovens, Inc., Cleveland, O.
Watson Machine Co., Paterson, N. J.

WIRE—Aluminum
Aluminum Co. of America, Pittsburgh, Pa.
Malin & Co., Cleveland, Ohio.

WIRE—Cast
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Cold Heading
American Steel & Wire Co., Cleveland-Chicago. New York.
Bethlehem Steel Co., Bethlehem, Pa.
Columbia Steel Co., San Francisco, Calif.
Continental Steel Corp., Kokomo, Ind.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Laclede Steel Co., St. Louis, Mo.
Roebling's John A., Sons Co., Trenton, N. J.
U. S. Steel Export Co., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Electric
American Brass Co, The, Waterbury, Conn.
Ansonia Electric Div. of Noma Electrical Corp., Ansonia, Conn.
Hudson Wire Co., Ossining, N. Y.
Malin & Co., Cleveland, Ohio.

WIRE—Enameled for Coils
North American Philips Corp., Dobbs Ferry, N.Y.
Winsted Div. of Hudson Wire Co., Winsted, Conn.

WIRE—Manufacturers
American Steel & Wire Co., Cleveland-Chicago.
Bethlehem Steel Co., Bethlehem, Pa.
Columbia Steel Co., San Francisco, Calif.
Continental Steel Corp., Kokomo, Ind.
Firth Sterling Steel Co., McKeesport, Pa.
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Laclede Steel Co., St. Louis, Mo.
Nichols Wire & Steel Co., Davenport, Iowa.
Reynolds Wire Co., Dixon, Ill.
Roebling's, John A., Sons Co., Trenton, N. J.
Rustless Iron & Steel Div., American Rolling Mill Co., Baltimore, Md.
Tennessee Coal, Iron & R. R. Co., Birmingham, Ala.
U. S. Steel Export Co., New York, N. Y.
Wickwire Brothers, Inc., Cortland, N. Y.
Wickwire Spencer Steel Div., of Colorado Fuel & Iron Corp., Buffalo, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Music
American Brass Co., The, Waterbury, Conn.
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Malin & Co., Cleveland, Ohio.

WIRE—Nickel & Nickel Alloy
International Nickel Co., Inc., New York, N. Y.

WIRE—Nickel Silver and Phosphor Bronze
American Brass Co., The, Waterbury, Conn.
Hudson Wire Co., Ossining, N. Y.
Malin & Co., Cleveland, Ohio.

WIRE—Non-Ferrous to Specification for Special Purposes
American Brass Co., The, Waterbury, Conn.
Hudson Wire Co., Ossining, N. Y.
North American Philips Co., Inc., Dobbs Ferry, N. Y.
Winsted Div. of Hudson Wire Co., Winsted Conn.

WIRE—Spring
American Brass Co., The, Waterbury, Conn.
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Indiana.
Firth-Sterling Steel Co., McKeesport, Pa.
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Rustless Iron & Steel Div., American Rolling Mill Co., Baltimore, Md.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Stainless Steel
American Steel & Wire Co., Cleveland, Chicago-New York.
Columbia Steel Co., San Francisco, Calif.
Firth-Sterling Steel Co., McKeesport, Pa.
Rustless Iron & Steel Div., American Rolling Mill Co., Baltimore, Md.
Tennessee Coal, Iron & Railroad Co., Birmingham, Ala.

WIRE—Steel—Also Coppered Steel—Also Galvanized Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Firth-Sterling Steel Co., McKeesport, Pa.
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
U. S. Steel Export Co., New York, N. Y.
Wickwire Brothers, Inc., Cortland, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Zinc
Platt Bros. & Co., The, Waterbury, Conn.

WIRE CLOTH—Industrial
Roebling's John A., Sons Co., Trenton, N. J.
Reynolds Wire Co., Dixon, Ill.

WIRE SPOOLING
Jersey Specialty Co., Little Falls, N. J.

WIRE TESTERS—
Scott Testers, Inc., Providence, R. I.

WIRE, WEAVING—Non-Ferrous
American Brass Co., The, Waterbury, Conn.
Hudson Wire Co., Ossining, N. Y.
Reynolds Wire Co., Dixon, Ill.

WIRE WINDER—
Standard Mill Supply Co., Providence, R. I.

WRAPPING PAPER—Creped
Crepe-Kraft Co., Newark, N. J.

YARNS & TAPES
Du Pont de Nemours, E. I. Co., Wilmington, Del.
General Electric Co., Schenectady, N. Y.
Owens Corning Fiberglas Corp., Toledo, Ohio.

YARN TESTERS—
Scott Testers, Inc., Providence, R. I.

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The WATSON MACHINE COMPANY

ESTABLISHED 1845

PATERSON 3, NEW JERSEY, U. S. A.

Wire & Wire Products

October, 1946

ELECTRICAL WIRE AND CABLE AND WIRE ROPE MACHINERY

"SHAFTLESS" COILING-REWINDER 50"/24" — TYPE "DMT"

PATENT PENDING

Available in two speed ranges, one for Insulated Wire and Cable and one for Wire Rope, this unit fills the long felt need for a compact motorized Coiling-Rewinder which offers the following OUSTANDING ADVANTAGES:

NEW SHAFTLESS DESIGN, fully ball bearing, very rugged for heavy duty. Reduces reel entrance and exit time to an absolute minimum. Permits rapid adjustment for any reel width within range.

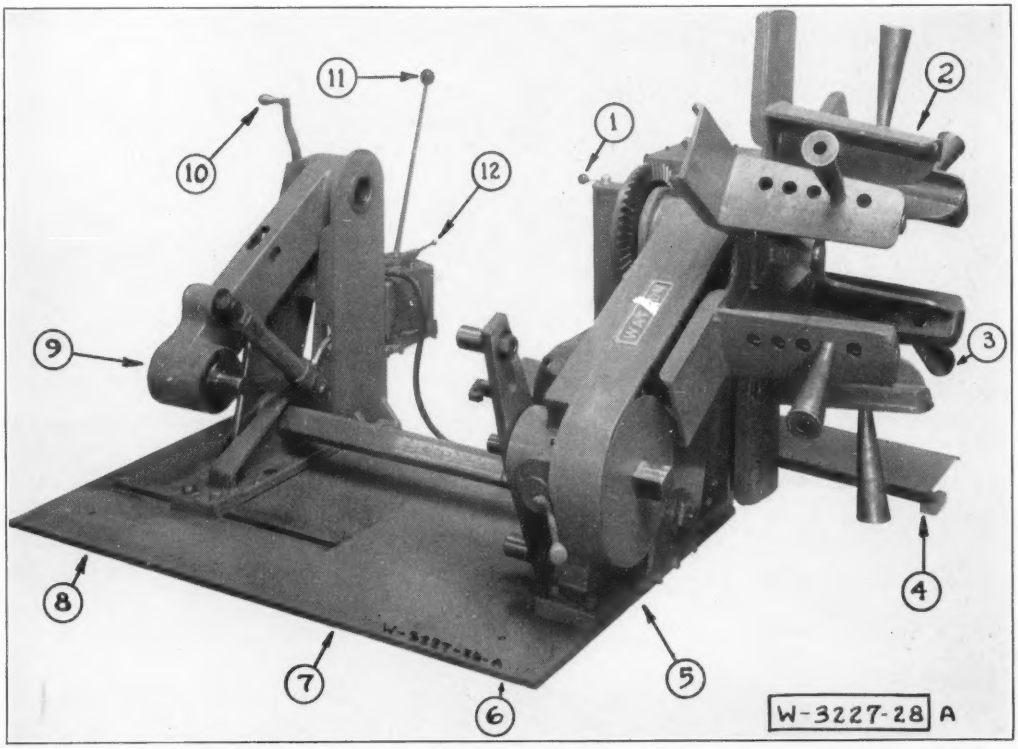
SAFETY is insured by the elimination of heavy reel shaft handling which does away with the possibility of accidental injury to the operator.

HYDRAULIC LIFT, functions with the greatest ease and provides for controlled lowering of reel to floor.

DRIVE ALWAYS IN MESH regardless of drive arm position, permits reeling at any height from floor. Only a very few pump strokes are required to raise reel clear of floor, ready for winding.

CAPACITIES: A maximum reel load of **three Tons.** Floor Pick-Up for reels of from 24" to 50" Flange Diameter with ample floor clearance. Reel width adjustment for reels of from 16" to 36" width (greater reel width may be specified, but minimum width will increase correspondingly i.e. 20" variation remains fixed).

6-SPEED DRIVE, Foot Treadle operated Clutch-Brake, permits gradual acceleration, controlled stops and intermediate slip-speeds.

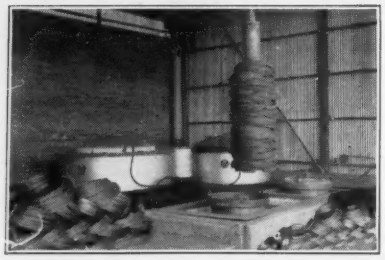


ENCIRCLED NUMBERS on Cut W-3227-28-A designate and locate:

1. — Electric Motor Control.
2. — Cone Pin Coiling Head 24" Size, for coils to 40" O.D
3. — Coil Width Adjustment Cones. Spring latches, to 12" widths.
4. — Foot Treadle, convenient location for reeling and coiling.
5. — Reel Drive and Lift Arm.
6. — Drive Dog Shift (insert-withdraw) Handle.
7. — Retractable Drive Dog. Adjustable (CL to CL) Dog Pins.
8. — Slideable (pintle withdrawal and reel width adj.) Lift Arm.
9. — Ball Bearing Reel Center Pintle.
10. — Lift Arm Slide Crank Handle.
11. — Hydraulic Lift Pump Handle.
12. — Lift Release Handle, for controlled reel lowering.

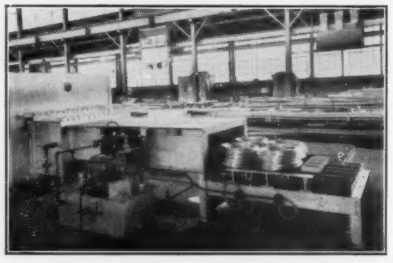
EF FURNACES

For Every Industrial Heat Treating Process



Normalizing and Annealing Rod

These E F circular pit type furnaces are used for bright annealing wire as well as for normalizing and spheroidizing rod. Efficient furnaces with excellent temperature distribution. Designed for firing with coke oven gas, mixed gases, natural gases, fuel oil or electrically heated.



Annealing Brass, Bronze, Nickel Silver, etc.

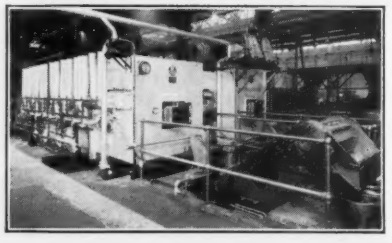
Copper, brass, bronze and nickel silver wire on spools or large reels; as well as strip and wire in coils are being clean and bright annealed, uniformly, in EF continuous special atmosphere bulkhead tray type furnaces similar to furnace at left. We build them in the size and type to fit the job.

Bright Annealing Copper Wire

This E F combination gas-electric furnace bright anneals 2500 lbs. of copper wire per hour — uniformly and continuously. Handles rod in coils as well as fine wire on spools or reels. The combination gas-electric feature combines the advantages of electric heating with the economy of gas heat. Investigate this feature.

Bright Annealing Strip, Wire, etc.

E F bell type furnaces maintain uniform temperature distribution throughout the material regardless of the size, weight or height of the charge. Equipped with motor driven fans, special atmosphere generators, radiant type gas burners and other E F features. This installation is bright annealing mirror-finish cold rolled strip.



Clean Hardening Bolts, Springs, etc.

This E F gas fired radiant tube continuous chain belt conveyor furnace is scale-free hardening bolts. Springs, gears, bearing parts and miscellaneous other products are hardened, uniformly, scale-free and continuously in E F electric and fuel fired furnaces similar to the above. Built in sizes to handle from 175 to 2000 lbs. per hour.

We build production furnaces for handling products in any size or shape. We solicit your inquiries. . . .
No job is too large or too unusual.

The Electric Furnace Co., Salem, Ohio

Gas Fired, Oil Fired and Electric Furnaces---For Any Process, Product or Production

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c.

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